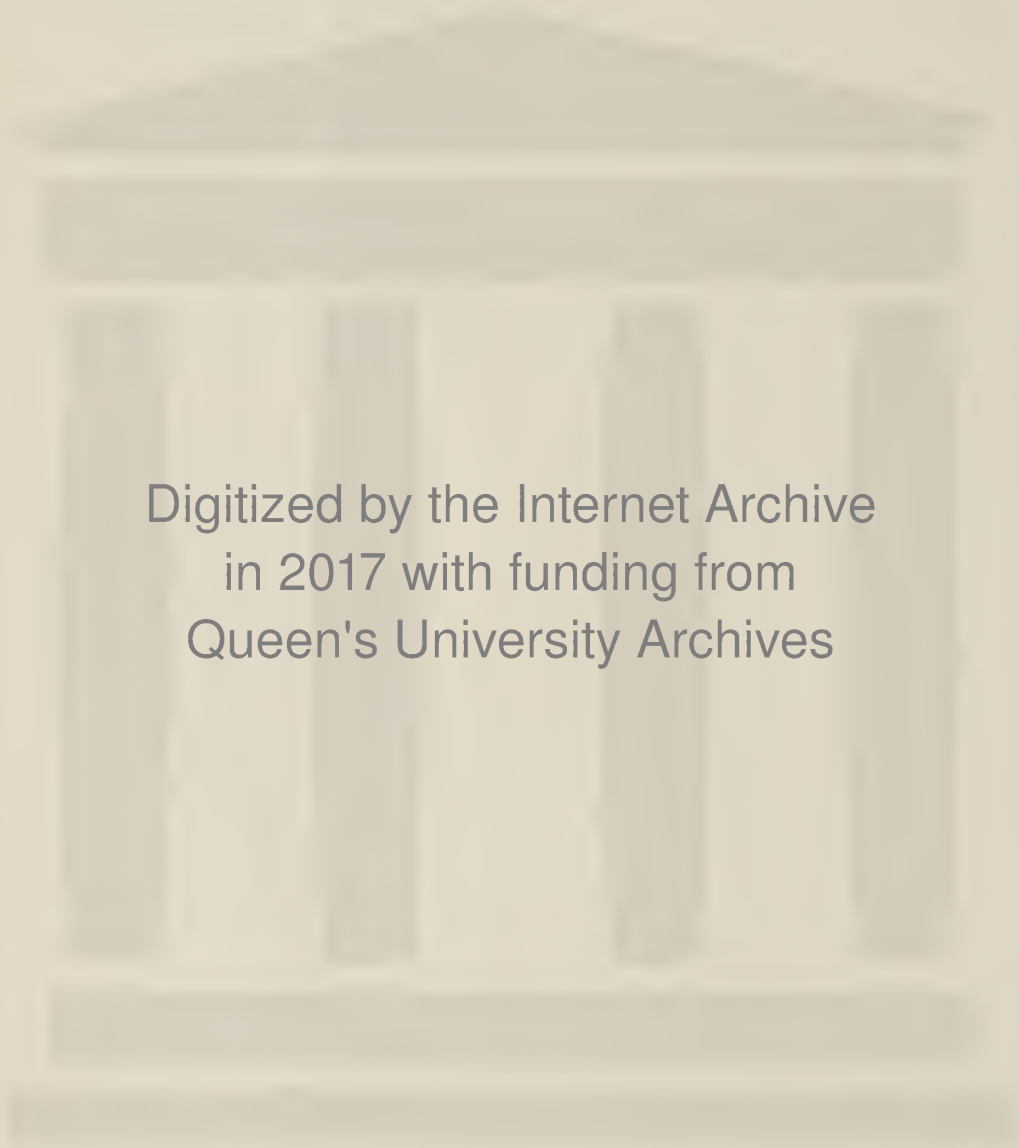

QUEEN'S UNIVERSITY

KINGSTON, CANADA

INCORPORATED BY ROYAL CHARTER IN 1841

CALENDAR

OF

THE FACULTY OF APPLIED SCIENCE

FIFTY-FIRST SESSION

1943-44

This Calendar is published five months before the opening of the session. Staff, courses, and regulations will probably be as announced, but the University reserves the right to make changes.

Special attention is directed to the following:

ANNOUNCEMENT OF

No. 2 CANADIAN ARMY UNIVERSITY COURSE

Queen's University, at the request of the Department of National Defence, Ottawa, will offer in the session 1943-44 to selected students from schools throughout the Dominion of Canada, an Army University Course thirty-three weeks in length, of which twenty-eight weeks will be used to cover the regular programme of the first year in the Faculty of Applied Science. Candidates applying for this course must have the academic standing regularly required for admission to the Faculty of Applied Science. They must be at least seventeen years of age and not older than twenty years; candidates under eighteen years will have to have the written consent of their parents.

Candidates who enlist in the Army University Course will be under military supervision and they will take military training. They will be provided by the Department of National Defence with free tuition and text books and free board and lodging. Up to the age of seventeen and one half years they will be paid seventy cents a day, after which they will go on the standard rates of army pay.

Candidates who complete the Course satisfactorily will have first year standing in the Faculty of Applied Science, and after the war they will be admitted to the second year of the four year Course in Applied Science.

Application for the Army University Course should be made to the Registrar of Queen's University, on forms which will be provided on request. The names of candidates whose standing is satisfactory to the University will be forwarded to the Department of National Defence so that arrangements may be made for medical examinations and enlistment in the Active Army. The final selection will be made by the Army.

QUEEN'S UNIVERSITY

KINGSTON, CANADA

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CALENDAR

OF

THE FACULTY OF APPLIED SCIENCE

FIFTY-FIRST SESSION

1943-44

PRINTED FOR THE UNIVERSITY BY
HANSON & EDGAR
KINGSTON
1943

CALENDAR

1943

JANUARY

S	M	T	W	T	F	S
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FEBRUARY

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MARCH

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1944

JANUARY

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FEBRUARY

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OCTOBER

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NOVEMBER

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DECEMBER

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ACADEMIC YEAR

1943

May 1—Written notice due at the Registrar's Office of candidates' intention to compete for Provincial Scholarships and Ontario Matriculation Scholarships.

July 15—Last day for applying for September examinations, or for degrees. Students applying after this date will be required to pay a late fee of $3.

Aug. 30—Shop Work for Courses F and G begins.

Aug. 30—Arts Supplemental Examinations begin.

Sept. 1—Last day for receiving applications for the Robert Bruce Bursaries.

Sept. 8, 9, 10—Supplemental Examinations in Applied Science.

Sept. 13—Surveying Field Class opens.

Sept. 28—Registration of First Year Students. Late fee after this date. ($3 on September 29 and $1 a day thereafter.)

Sept. 29—Classes of First Year open at 8 a.m.

Sept. 29—Registration of Second, Third and Fourth Years. Late fee after this date. ($3 on September 30 and $1 a day thereafter.)

Sept. 30—Classes of Second, Third and Fourth Years open at 8 a.m.

Oct. 9—Last day of registration (with extra fee) of students in Applied Science who have not previously obtained from the Faculty permission to register later.

Oct. 16—University Day.

Dates of the Christmas examinations for 1st and 2nd years to be announced.

Dec. 22—Christmas holidays begin at noon.

1944

Jan. 4—Examinations in half courses of the first term begin at 2 p.m.

Jan. 4—Classes in whole courses re-open at 8 a.m.

Jan. 6—Classes in half courses of the second term begin at 8 a.m.

Last day for payment of second instalment of fees without penalty.

Feb. 11-12—Mid-term holiday.

Mar. 15—Last day for receiving applications for graduation.

Apr. 1—Last day for receiving manuscripts and essays for prizes.

Apr. 1—Classes close at 5 p.m.

Apr. 7—Good Friday.

Apr. 11—Examinations begin.

May 20—Convocation for distributing prizes, announcing honours and conferring degrees. (This date is provisional).

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[1]Elected by the University Council for three years.
[2]Elected by the Benefactors for four years.
[3]Elected by the Graduates for three years.
[4]Elected by the Board of Trustees to represent the Faculty of Applied Science for three years.
[5]Elected by the Faculty of Queen's Theological College for one year.
[6]Elected by the Board of Trustees for four years.
[7]Elected by Benefactors to represent the Faculty of Applied Science for three years.

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Associate Professor of Mathematics, Annandale Apts., Sydenham Street

G. B. Frost, B.A., Ph.D.,
Associate Professor of Chemistry, Annandale Apts., Sydenham Street

L. A. Munro, M.A., Ph.D., F.C.I.C.,
Associate Professor of Chemistry, 93 Beverley Street.

J. F. Logan, B.A., A.M., Ph.D.,
Associate Professor of Chemistry, 154 Union Street West.

R. L. Dorrance, M.A., F.C.I.C.,
Associate Professor of Chemistry, 81 Lower Union Street

H. H. Stewart, B.Sc., M.S.,
Associate Professor of Electrical Engineering, 288 Collingwood Street.

O. A. Carson, B.Sc., A.M., Ph.D.,
Assistant Professor of Metallurgy, 72 Barrie Street

G. L. Edgett, M.A., Ph.D.,
Assistant Professor of Mathematics, 41 Traymoor Avenue.

*Deceased, December 1942.

B. W. Sargent, M.A., Ph.D., F.R.S.C. (on leave of absence),
Assistant Professor of Physics, 131 King Street East.

E. E. Watson, M.Sc., Ph.D.,
Assistant Professor of Physics, 82 Traymoor Avenue.

H. M. Cave, M.A., Ph.D. (on leave of absence),
Assistant Professor of Physics, 133 King Street.

R. A. Low, B.Sc., M.C.E.,
Assistant Professor of Civil Engineering, 98 Clergy Street West.

J. B. Baty, B.Sc.,
Assistant Professor of Civil Engineering, On Active Service.

H. W. Harkness, B.Sc., B.A., M.Sc., Ph.D.,
Assistant Professor of Physics, 181 University Avenue.

C. J. Vincent, A.M., Ph.D.,
Assistant Professor of English, 105 Hill Street.

C. V. Armour, M.A.Sc.,
Assistant Professor of Civil Engineering, 42 Napier Avenue.

I. Halperin, M.A., Ph.D.,
Assistant Professor of Mathematics, On Active Service.

G. A. Revell, M.Sc., F.C.I.C.
Assistant Professor of Chemical Engineering, 34 Traymoor Avenue.

H. S. Pollock, M.Sc.,
Assistant Professor of Electrical Engineering, 435 Frontenac Street.

W. A. Wolfe, M.Sc.,
Assistant Professor of Mechanical Engineering, 88 Collingwood Street.

S. D. Lash, B.Sc., Ph.D., A.C.G.I.,
Assistant Professor of Civil Engineering, 103 Dundas Street.

H. J. Styles, B.Sc.,
Lecturer in Draughting, On active service

William Angus, A.M., Ph.D.,
Lecturer in English, 22 Collingwood Street.

N. W. Buerger, S.M., Ph.D., F.M.S.A.,
Lecturer in Mineralogy, On active service.

H. G. Conn, B.Sc. (on active service),
Lecturer in Mechanical Engineering, 288 Victoria Street.

E. G. Taylor, B.Sc., Sc.M., Ph.D., (Wales) A.I.C.,
Lecturer in Chemistry, 19 George Street.

M. L. Keith, M.Sc., Ph.D.,
Lecturer in Geology, 33 Lower William Street.

J. D. Lee, B.Sc.,
Lecturer in Civil Engineering, 402 Johnson Street.

R. N. Jones, B.Sc., Ph.D.,
Lecturer in Chemistry, 209 Stuart Street.

O. T. Macklem, B.Sc.,
Special Lecturer in Civil Engineering, 18 Barrie Street.

R. A. Chipman, Ph.D.,
Lecturer in Physics, 31 George Street.

R. H. Hay, M.Sc.,
Lecturer in Physics, 619 Victoria Street.

Instructor in Physics: A. Vibert Douglas, M.B.E., M.Sc., Ph.D.

Instructors in Draughting: H. I. Marshall, B.Sc.; D. Jack, M.Sc.; W. E. Gorham.

Instructors in Physical Training: J. F. Edwards, B.Sc. (on active service); R. Seright, B.Sc.

Instructor in Shop Work: A. C. Baiden.

Instructor in Blacksmithing: C. Brown.

ASSISTANTS AND DEMONSTRATORS

Chemistry: W. W. Maynard, B.Sc.; R. Y. Moir, B.A.; A. G. Stewart, B.A.

Civil Engineering: C. H. Ellacott, B.Sc.

Draughting: A. R. Asquith, B.Sc.; D. M. MacKeracher, B.Sc.

Electrical Engineering: H. I. Hamilton, B.Sc.; N. A. Williams, B.Sc.

Mathematics: P. T. Demos, B.Sc.; R. H. Hay, M.Sc.

Mineralogy: J. M. Harrison, M.A.

Physics: R. A. Burr, B.Sc.

UNDERGRADUATE ASSISTANTS AND DOUGLAS TUTORS

R. H. Abbott, E. M. Abraham, W. H. Bechtel, A. D. Berlin, C. H. R. Campling, E. L. Dauphin, N. B. H. Dean, E. Diamond, H. E. Gove, H. W. Habgood, R. S. Haflidson, W. H. Henry, A. F. Holloway, A. C. G. Jarvis, R. J. Merrill, A. G. Moreton, J. E. Moyle, A. M. Munn, B. J. McColl, D. C. McWhirter, J. C. Orr, L. A. Page, J. D. Patterson, W. F. Reid, W. A. Runge, L. K. Rutledge, A. C. Wise, G. M. Wright, H. R. Yamanaka, M. E. Young.

OTHER OFFICERS

LIBRARIAN

E. C. Kyte

CURATORS OF THE LIBRARY

Principal Wallace, Principal Kent, Vice-Principal McNeill, Dean Clark, Dean Matheson, Dean Etherington, Professors James Miller, Corry, J. K. Robertson, Shaw and Trotter.

CURATORS OF THE MUSEUM

The Professors of Biology and Geology

DIRECTOR OF ENDOWMENT

Gordon J. Smith, B.A., B.Sc.

DIRECTOR, DEPARTMENT OF UNIVERSITY EXTENSION

R. M. Winter, M.A. (on Active Service)*

SUPERINTENDENT OF BUILDINGS

James Bews

SECRETARY-TREASURER ATHLETIC BOARD OF CONTROL

Charles Hicks

SECRETARY-TREASURER GENERAL ALUMNI ASSOCIATION, MANAGER OF EMPLOYMENT BUREAU

H. J. Hamilton, B.A. (on leave of absence)**

G. J. Smith, B.A., B.Sc. (acting)

MEDICAL OFFICER

J. T. Tweddell, M.D., C.M.

* Flight-Lieutenant, Royal Canadian Air Force.

** Office Manager, Wartime Bureau of Technical Personnel.

ADMINISTRATION AND GOVERNMENT

The administration of the University is vested in the Board of Trustees, the University Council, the Senate, and the Faculty Boards.

THE BOARD OF TRUSTEES

The Board of Trustees consists of *ex-officio* and elective members. The former are the Chancellor, the Principal, and the Rector. The latter consist of (1) one representative from each affiliated college, (2) representatives as provided for by the Statutes from (*a*) the University Council, (*b*) the Benefactors, (*c*) the Graduates, and (3) members elected by the Board of Trustees.

The functions of the Board of Trustees are to manage the finances, to possess and care for the property, to procure legislation, to appoint instructors and other officers, and in general to attend to such external matters as do not relate directly to instruction.

THE UNIVERSITY COUNCIL

The University Council consists of the Chancellor, the Trustees, the members of the Senate, and an equal number of members elected by the graduates from their own members.

The Functions of the Council are:

(1) To elect the Chancellor, except when two or more candidates are nominated, in which case the election is by registered graduates.

(2) To elect six trustees, two of whom shall retire annually.

(3) To make by-laws governing the elections of (*a*) the Rector by the registered students, (*b*) seven trustees by the benefactors, (*c*) six trustees by the University Council, and (*d*) six trustees by the graduates.

(4) To discuss all questions relating to the University and its welfare.

(5) To make representation of its views to the Senate or the Board of Trustees.

(6) To decide on proposals for affiliation.

(7) To arrange all matters pertaining to (*a*) its own meetings and business, (*b*) the meetings and proceedings of Convocation, (*c*) the installation of the Chancellor, and (*d*) the fees for membership, registration, and voting.

Ordinarily the annual meeting of the Council is held on the day before the spring Convocation.

THE SENATE

The Senate consists of:

The Principal.
The Vice-Principal.
The Principal of Queen's Theological College.
The Dean of the Faculty of Arts.
The Dean of the Faculty of Applied Science
The Dean of the Faculty of Medicine.
Three Professors elected by the Faculty of Arts.
Three Professors elected by the Faculty of Medicine.
Three Professors elected by the Faculty of Applied Science.
Two Professors elected by the Faculty of Queen's Theological College.
The Registrar.

The Functions of the Senate are:

(1) To determine all matters of an academic character which concern the University as a whole.

(2) To consider and determine all courses of study leading to a degree, including conditions of Matriculation, on recommendation of the respective Faculty Boards; but the Senate shall not embody any changes without having previously presented these to the Faculty.

(3) To recommend to the Board of Trustees the establishment of any additional Faculty, Department, Chair, or Course of Instruction in the University.

(4) To be the medium of communication between the Alma Mater Society and the Governing Boards.

(5) To determine all regulations regarding the social functions of the students within the University, and regarding the University Library and University Reading Rooms.

(6) To publish the University Calendars.

(7) To conduct examinations.

(8) To grant Degrees.

(9) To award University Scholarships, Medals, and Prizes.

(10) To enforce the Statutes, Rules, and Ordinances of the University.

(11) And generally, to make such recommendations to the Governing Boards as may be deemed expedient for promoting the interests of the University.

THE FACULTY BOARDS

The Faculty Boards are constituted as follows:

For the Faculty of Arts and for the Faculty of Applied Science, the Dean, Professors, Associate Professors, Assistant Professors, and Lecturers of each Faculty have power to meet as separate boards, and to administer the affairs of each Faculty under such regulations as the Board of Trustees may prescribe.

For the Faculty of Medicine, the Dean, Professors, Associate Professors, and Assistant Professors have power to meet as a separate board, and to administer the affairs of the Faculty under such regulations as the Board of Trustees may prescribe.

The Principal and Vice-Principal are *ex-officio* members of each of the Faculty Boards.

The Functions of the Faculty Boards are:

(1) To recommend to the Senate courses of study leading to a degree, and the conditions of admission.

(2) To decide upon applications for admission or for change of course, subject to the regulations of the Senate.

(3) To submit to the Senate names for both ordinary and honorary degrees.

(4) To arrange the time-table for classes and to edit the Faculty Calendar, subject to the approval of the Senate.

(5) To control registration, and to determine the amount of fees and manner of payment, subject to the regulations of the Senate and the approval of the Board of Trustees.

(6) To deal with class failures.

(7) To exercise academic supervision over students.

(8) To make such recommendations to the Senate as may be deemed expedient for promoting the efficiency of the University.

(9) To award Faculty Scholarships, Medals, and Prizes.

(10) To appoint, within the limits of the funds made available by the Trustees, such sessional assistants, fellows, tutors, and demonstrators as shall be needed to give instruction in the subjects taught by the Faculty.

(11) To pass such regulations and by-laws as may be necessary for the exercise of the functions of the Faculty.

HISTORICAL NOTE

The School of Mining, now the Faculty of Applied Science, Queen's University, was founded in 1893 under an Ontario Charter which placed its management in the hands of a Board of Governors elected by its shareholders, i.e., the subscribers to its funds. While originally a Mining School it has been expanded to include courses of study for degrees in mining and metallurgy, in civil, mechanical, electrical, and chemical engineering, in analytical chemistry and assaying, in physics, and in geology and mineralogy. The objects of the institution were to provide thorough instruction both theoretical and practical, in the above and other branches of applied science, and to adapt courses of study and methods of presentation to the conditions prevailing in Canada, so as to secure as nearly as may be a maximum usefulness to the country.

For several sessions all its Departments were housed in Carruthers Science Hall, which had been erected in 1889, but in view of the rapid success and increased requirements of the School the Provincial Legislature in 1900 provided for its accommodation two large buildings, Ontario Hall for the Departments of Mineralogy, Geology, and Physics, and Fleming Hall, for the Departments of Civil, Mechanical, and Electrical Engineering. More recently the Provincial Government erected Gordon Hall, which is entirely devoted to Chemistry; and, through the generosity of Professor Nicol and other graduates, Nicol Hall was built for the accommodation of the class rooms and laboratories of the Department of Mining and Metallurgy. These changes permitted the Civil Engineering Department to move into Carruthers Hall, leaving room in Fleming Hall for the already overcrowded departments of Electrical and Mechanical Engineering. Miller Hall, one of the finest buildings on the campus, was opened in 1931 for the Departments of Mineralogy and Geology, permitting the Department of Chemical Engineering to move into Ontario Hall.

From its inception the School of Mining was closely connected with the University. The students of the School of Mining received their degrees

from the University and the graduates in Science enjoyed the same rank and privilege as other graduates in representation upon the University Council and in the election of University Trustees. The staff of the School of Mining constituted practically the Science Faculty of the University, some of its members being actively connected also with the Arts and Medical Faculties, and the Faculty being represented with other faculties on the Senate of the University.

The School of Mining was formerly under the control of a separate board of Governors, but in the year 1916 it became the Faculty of Applied Science of Queen's University.

Kingston is well situated as the seat of a college of engineering and applied science. Geology and mineralogy, two of the fundamental subjects of a mining engineer's education and also important in other scientific professions, are studied to best advantage where the minerals can be seen as they lie in nature, and where geological formations can be examined in *situ*. In a few hours a class of students can be taken to a region so rich in mineral species that about forty different kinds have been secured in an afternoon. There are several geological formations out-cropping within easy walking distance of the city. If to this be added the accessibility by a short railway journey of mines in operation, it will be seen that the opportunities for instructive demonstrations to classes in mineralogy, geology, and mining are very numerous. The metallurgical works at Deloro, eighty miles from Kingston, are also open to our students. It is thus possible to give to the study of mineralogy, geology, mining, and metallurgy, that practical turn which not only adds interest to the college course, but shortens the period between graduation and the attainment of proficiency and of confidence in professional work.

The variety of topographical features in the surrounding country affords the best of material for practice in all branches of surveying, including railway, topographic, hydrographic, and land surveying. The main line of the Canadian National passes through Kingston, which is also a terminus of the Canadian Pacific Railway. The Canadian Locomotive Works, which are the largest locomotive shops in Ontario, are within ten minutes' walk of the University, and are open to students for study and for assisting in engine testing and similar work. Kingston has a large Dry Dock, in whose yards steel construction can be studied practically. The locks of the Rideau Canal can be visited at Kingston Mills, six miles from the heart of the city. There are also several water powers within easy distance. Students of civil, mechanical, and electrical engineering thus have easy access to practical illustrations of their professional studies.

EQUIPMENT AND SPECIAL FACILITIES

THE LIBRARY

The Douglas Library building provides one large reading room, three smaller ones, a number of conference rooms, exhibition rooms and offices for the library and administrative staff.

In the main reading room will be found a collection of some 5,000 volumes of general reference works on open shelves. The general library includes about 160,000 volumes as well as many original manuscripts and prints.

The system of classification used is that of the Library of Congress.

Seven hundred and fifty journals and other serials are currently received.

In addition to the general library there are departmental libraries for physics; chemistry; chemical engineering; mining and metallurgy; geology and mineralogy; civil, mechanical and electrical engineering.

The library of the Medical Faculty together with a biological library, is separately housed in the Old Arts Building.

The Lorne Pierce Collection of Canadian Literature is very rich in first editions, original manuscripts and rare Canadiana.

The Shortt-Haydon Collection of portraits and views relating to Canada is one of the finest collections of its kind.

THE MUSEUMS

The Miller Memorial Museum, named in memory of the late Willet G. Miller, formerly Provincial Geologist of Ontario, has been erected for the Departments of Geology and Mineralogy. The main floor is entirely devoted to museum purposes and contains among other things an excellent collection of economic minerals used in industrial processes; a collection of at least a thousand mounted individual crystals, large collections illustrating the systematic classification of minerals and rocks; another illustrating the ores found particularly in Canadian mines, a stratigraphic assembly of rocks and a paleontological collection illustrating the geologic life record.

An Ethnological collection of weapons, utensils, dresses, and ornaments is also housed in the east wing of the museum.

The Biological Museum, in the Old Arts Building, has a large Botanical collection illustrating fully the flora of North America, Europe, Asia, South Africa, and Australia; a Zoological collection representing the Canadian fauna by a large number of prepared specimens of mammals, birds, reptiles, fishes, insects, and mollusca.

THE LABORATORIES

The Chemical Laboratories are in Gordon Hall. On the fourth floor are the laboratories of Medical Organic, Biochemistry, and Water Analysis.

On the third floor are two laboratories for General Chemistry, and a laboratory for Electro-chemistry and Colloid Chemistry. On the second or main floor are two laboratories for Quantitative Analysis, two for Organic Chemistry, and one for Industrial Chemistry. On the first or basement floor are three laboratories for Qualitative Analysis, and two for Physical Chemistry. Besides these there are a number of small separate laboratories for research work.

The Physics Laboratories occupy the major part of Ontario Hall. The basement contains the large elementary laboratory, the liquid air room, numerous research laboratories and the research workshop. The main floor is given over to undergraduate lecture and laboratory rooms. The second floor has two large lecture rooms, laboratory room for advanced undergraduate classes and for research. The attic is used for workshop and storage purposes.

The Geological and Mineralogical Laboratories are in Miller Hall. In the basement is a laboratory for the preparation of rock sections and for photography and an X-ray laboratory equipped with a Hilger X-ray spectrograph. On the second floor a laboratory occupying the west wing is for elementary classes in Geology. Along the north side of the building is a map room and the petrographical laboratory. On the south side a large draughting room is used by senior students for the preparation of maps and sections required in field courses. On the third floor at the west end is a large laboratory for blowpipe analysis, a dark room equipped with a two circle goniometer, a monochromator and Abbé refractometer. The east wing is a laboratory for postgraduate students, a dark room for photography, a chemical laboratory with space for twelve students, a grinding room for preparation of polished surfaces and an adjoining optical laboratory for petrographic and mineralographic work. Smaller laboratories for research work are equipped with a Hilger E316 spectrograph, a Hallimond Electromagmatic concentrator and facilities for examination of ores by polarized light.

The Biological Laboratories are on the main floor and in the basement of the Old Arts Building. There is a large laboratory for General Botany, one for General Zoology, and one for Medical Biology, as well as smaller laboratories for Plant Physiology and Advanced Botany. Laboratories are available also for research in Plant Physiology, Cytology, and the growth of populations. A very carefully arranged and classified collection of representative invertebrate animals as well as a small but growing entomological collection are available for study. These supplement the Herbarium and the collection of larger animals in the Museum.

THE OBSERVATORY

The Observatory has a transit room, a computing room, and an equatorial room with revolving dome. The equatorial telescope has a six-inch objective, declination and right ascension circles, and a driving clock. The transit has a

three and a half inch objective. The further equipment consists chiefly of a striding level, a chronograph, a mean time clock, and a sidereal time clock.

THE MUSIC ROOM

The Music Room in the Douglas Library is ideally furnished and equipped for music study and listening. It houses the Carnegie collection of more than a thousand gramophone records, and a number of musical scores and books which are available on loan through the usual library facilities. The equipment also includes a Steinway grand pianoforte, a radio-phonograph, and a high-fidelity phonograph with separate loud-speaker console. The room is open every afternoon during the session, including Saturday and Sunday.

FACILITIES FOR FIELD WORK

Geology and Mineralogy. In the vicinity of Kingston a greater variety of economic minerals and metalliferous ores is mined than in any similar area in Canada. Through the kindness of the managers the various mines may be visited by the Geology and Mineralogy classes, and students may thus obtain valuable information concerning field conditions.

Botany and Zoology. Exceptionally good facilities for field study are provided in the vicinity of Kingston by the great diversity of land surfaces and bodies of water. A wide range of plant and animal associations is within easy reach of the University.

ENGINEERING SOCIETY

The representative student organization of the Faculty of Applied Science is the Engineering Society. All students registered in the Faculty of Applied Science are members of this society. Regular monthly meetings are held and the Society has been fortunate, in recent years, in securing successful engineers to address the students during the session. Any student member who wishes to read a scientific paper before the society will always find the executive of the Engineering Society ready and willing to arrange a date. Prizes are offered in connection with such student papers.

The Society conducts a Technical Supplies Department, where all books prescribed, stationery, note books, drawing paper and instruments, and other supplies, may be purchased at prices but slightly over cost. Any books not in stock will be ordered on payment of a small deposit.

FACILITIES FOR ATHLETICS

The University provides ample facilities for athletics. A gymnasium, one of the finest in Canada, was built during the summer of 1930. In the University Grounds is a large covered skating rink with artificial ice. Adjoining the University is the football field, with the George Richardson Memorial Stadium given by Dr. James Richardson, formerly Chancellor of the University, in memory of his brother, Captain George Richardson, a Queen's graduate and a former athlete, who was killed in the Great War. There is room and equipment for all students who wish to take part in football, hockey, basketball, tennis, track athletics, swimming, boxing, fencing, or wrestling.

REQUIREMENTS FOR ADMISSION.

The number of students admitted to the first year of the Faculty of Applied Science is limited. Selection from applicants for admission will be made on the basis of their qualifications. Candidates must make application by September 1st on forms which may be obtained from the Office of the Registrar. This application must be accompanied by academic certificates, a certificate of successful vaccination, a photograph 2" x 3", and a fee of $10 which will be applied on tuition payable at registration. This fee will be returned up until one week before the opening of the session if the student notifies the University that he cannot register.

I.—ADMISSION BY MATRICULATION.

*The requirements for admission to the Faculty of Applied Science are as follows:

Part I. The Ontario Secondary School Graduation Diploma with standing in the following subjects: *English, History, Mathematics, (Algebra and Geometry), Experimental Science (Physics and Chemistry) or Agriculture (Parts I and II), and any two of Latin, Greek, French, German, Spanish, Italian, or Arithmetic.* Arithmetic to be offered by candidates from technical schools only.

Part II. Grade XIII in the following subjects: *English, Mathematics (Algebra, Geometry, including Analytical Geometry, and Trigonometry with an average of 60%), Experimental Science (Physics and Chemistry), and one of Latin, Greek, French, German, Spanish, Italian, History, Biology.*

Note:—Grade XIII standing in History, or in Biology, or in a Foreign Language, not offered under Part II may be substituted for one of the Languages of Part I.

Candidates who have had practical engineering training or who are otherwise specially qualified for an Engineering Course may be admitted at the discretion of the Faculty, on conditions to be determined in each case, even though they do not present precisely the subjects named above.

Candidates entitled to enter the Faculty of Arts may satisfy the requirements of Part II by extramural and Summer School work.

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*The experience of many years has shown that a good foundation in and a liking for Mathematics are essential for success in a Science Course.

II.—ADMISSION BY EQUIVALENT EXAMINATION

The following certificates are accepted provided that the subjects covered are the same as the subjects of the Ontario Secondary School Graduation Diploma.

Alberta	Junior Matriculation (Grade XI).
British Columbia	Junior Matriculation (Grade XII).
Manitoba	Grade XI.
New Brunswick	Junior Matriculation.
Newfoundland	Associate (Junior).
Nova Scotia	Grade XI. (average 60, minimum 50).
Ontario	Ontario Secondary School Graduation Diploma.
Prince Edward Island	First Class Teachers' License or Second Year Certificate from Prince of Wales College.
Quebec	Quebec School Leaving Certificate. McGill Junior Matriculation.
Saskatchewan	Grade XI.

Any one of the following certificates will be accepted in place of Ontario Grade XIII in the same subjects if the required standing has been made in the subjects covered.

Alberta	Senior Matriculation (Grade XII).
British Columbia	Senior Matriculation (Grade XIII).
Manitoba	First Class.
New Brunswick	Grammar School or First Class Licenses.
Newfoundland	Associate Grade.
Nova Scotia	Grade XII.
Ontario	Grade XIII.
Prince Edward Island	Honour Diploma of Third Year, Prince of Wales College.
Quebec	McGill Senior Matriculation. Senior High School Leaving Certificate.
Saskatchewan	Grade XII.
Great Britain	The School Certificate of the various English Universities and the Central Welsh Board; the candidate will be granted Grade XIII standing in those subjects in which he has obtained "credit". Similar standing will be given those having the Leaving Certificate of the Scottish Education Department provided that the subjects are of the Higher Standard.

NOTE.—A certificate from any school which is on the list of schools approved by any University or Technical College of recognized standing in the United States will be accepted as equivalent to matriculation examination *pro tanto*.

III.—ADMISSION TO ADVANCED STANDING

A student who transfers to Queen's University from another educational institution will be admitted to the year for which he is qualified. Ordinarily such a student must spend a minimum of two years in residence in order to obtain the Bachelor of Science degree. Since laboratory accommodation is limited, it may be necessary to refuse admission to certain Courses.

A candidate for advanced standing must submit with his application a Calendar of the institution in which he has studied, together with an official statement of the subjects passed and the standing made.

IV.—ADMISSION OF SPECIAL STUDENTS

Students not proceeding to a degree may take any classes for which they are prepared. The work in all classes is so arranged that those who wish to study, either for scientific interest or to improve their qualifications for any particular position, may profitably pursue their studies in the Faculty of Applied Science.

The Faculty will admit under this paragraph, as special students, only such candidates as are fitted to take part of the classes of a course. It will not admit as special students those whom, on account of previous poor records, it is no longer desirable to retain as regular students.

Prospective students under this section should correspond with the Dean of the Faculty of Applied Science in regard to the arrangement of such a course.

MEDALS, FELLOWSHIPS, SCHOLARSHIPS AND PRIZES

I.—MEDALS

Governor-General's Medal

The Governor-General's Medal is awarded each year to the student of the graduating class who has made the highest standing throughout the four years of his Course. A student who has lost a year is not eligible. Grades obtained on supplemental examinations will not be included in determining the candidate's standing.

Departmental Medals

A medal may be awarded annually in each department to the student of the graduating class who has made the highest average standing in all subjects of the third and fourth years, and secured honour standing in his fourth year.

II.—GRADUATE FELLOWSHIPS AND SCHOLARSHIPS

FELLOWSHIPS CONTROLLED BY THE UNIVERSITY

Science Research Fellowships

1. Applications for Fellowships will be received by the Registrar up to May 1st. If no appointment is made by that date further applications will be received up to September 1st.

2. Fellows will be selected and the character of their work will be determined by the Department concerned in consultation with the Dean. The University reserves the right to dismiss a Fellow whose work is not satisfactory.

3. A student appointed to a Fellowship must carry on research work for the whole session and embody the results in a thesis. The research may take the form either of independent investigation or of assistance in an investigation carried on by some department. The Fellow may be required to undertake tutorial work not to exceed six hours a week.

4. The income of the Fellowship will be paid in five instalments, of which the last will be paid only after the thesis has been accepted. A candidate for degree at the May Convocation must submit his thesis by April 20. Except by special permission, other Fellows must submit their theses not later than September 20.

The C.I.L. Fellowship in Chemistry and Chemical Engineering

Value $750. Founded by the Canadian Industries Limited for research in Chemistry or Chemical Engineering. This is a Resident Fellowship open to graduates of Queen's or other Universities. Applications must be received by the Registrar by April 1st.

The Milton Hersey Fellowship in Chemistry

This Fellowship of the annual value of $400, has been endowed by Milton L. Hersey, M.Sc., LL.D., of Montreal. It is open to graduates of all universities and technical colleges.

The holder of this Fellowship shall carry on research work for the whole session and embody the results in a thesis. The research may take the form either of independent investigation or of assistance in an investigation carried on by some department. The Fellow may be required to undertake tutorial work not to exceed six hours a week.

Applications for Fellowships will be received by the Registrar up to May 1st. If no appointment is made by that date, further applications will be received up to September 1st.

William Neish Fellowship in Chemistry

This Fellowship of an annual value of $400 has been endowed by Ada E. Neish and Laura Neish Black of Kingston. It is open to graduate students in Chemistry from Queen's or another University.

The holder of this Fellowship shall carry on research work at Queen's for the whole session under the direction of some member of the Department of Chemistry and embody the results in a thesis. The Fellow shall be required to give laboratory instruction or its equivalent not to exceed nine hours a week.

Inco Scholarship

The International Nickel Company of Canada has established a Scholarship of the value of $500 for graduate work in Chemistry, Chemical Engineering, Mining, Metallurgy, Geology and Mineralogy, to be awarded to a student holding the Bachelor of Science degree, who has made consistently high standing throughout the four years of his undergraduate Course.

Applications must be submitted by April 1st each year.

J. B. Tyrrell Scholarship in Economic Geology

Founded by J. B. Tyrrell, LL.D., of Toronto.

Value dependent on dividends received. This Scholarship will be awarded to a graduate student who is working in the field of Economic Geology.

Applications must be submitted by April 1st each year.

The Reuben Wells Leonard Fellowships

Under the will of the late Reuben Wells Leonard provision was made for four Fellowships of the value of $500 to be awarded to graduates of the University "who are willing and qualified to undertake independent research work in the interests of higher culture". These Fellowships are tenable only by students in attendance at Queen's.

Application must be made to the Registrar not later than April 1st.

The Reuben Wells Leonard Fellowships

Fellowships of varying amounts will be available during session 1943-44 for Queen's graduates continuing their work at Queen's University. Application for these Fellowships must be received by April 1.

Postgraduate Scholarship in Chemical Engineering

This Scholarship established by a friend of the University, and of the value of $300 is to be awarded on recommendation of the Department of Chemical Engineering and the Dean of the Faculty of Applied Science to a student at the end of the fourth year of the Chemical Engineering course on the basis of ability, academic record, character and personal qualifications.

The purpose of this Scholarship is to enable a student to devote a year to postgraduate study, attending a number of lecture courses, and devoting part of his time to research work.

FELLOWSHIPS NOT CONTROLLED BY THE UNIVERSITY

Royal Society of Canada Fellowships

Ten annual fellowships to be known as the Royal Society of Canada Fellowships, each of $1500, and open on equal terms to men and women,

have been endowed through the generosity of the Carnegie Corporation. They are tenable at institutions of learning or research, save in exceptional circumstances outside of Canada, and are available for advanced research in Literature, History, Anthropology, Sociology, Political Economy, or allied subjects, in French or English; and in Mathematics, Chemistry, Physics, Geology, Biology, or subjects associated with any of these sciences.

An applicant for a Fellowship should be a graduate of a Canadian university or college, or should have received an equivalent training in a Canadian institution possessing adequate facilities in his particular subject, and, except in special cases, should have the Master's degree or its equivalent, or, preferably, have completed one or more year's work beyond that degree.

Applications, addressed to "The Secretary, Royal Society of Canada Fellowships Board, Ottawa, Canada," should contain particulars of the candidate's age and place of birth, a full statement of his academic career, with copies of original papers and any other evidence of his ability or originality in his chosen field; also an indication of the particular work he proposes to undertake, at what institution, and under whose direction; and should be supported by recommendations from the head of the department of the institution in which the candidate has studied, and from the instructors under whom he has chiefly worked. All these papers should be in duplicate.

Further particulars may be obtained from the Registrar.

The following graduates of Queen's have held these Fellowships:

1932-33, Christine Rice; 1932-33, H. W. Fairbairn; 1933-34, G. A. Harcourt; 1936-37, W. C. Güssow; 1937-38, A. W. Currie; 1938-39, J. S. Marshall; 1941-42, J. Dingwall; 1942-43, J. L. Evans.

These fellowships will not be awarded again until after the war.

Exhibition of 1851 Science Research Scholarship.

This scholarship, of the annual value of £250 sterling, is awarded by Her Majesty's Commissioners for the Exhibition of 1851 to students who have given evidence of capacity for original research, and are under 26 years of age. A given number of scholarships are awarded annually to students in Canada recommended by the Universities approved by the Commissioners.

The nominee must be a British subject, must have been a bona fide student of science for three years, must have been a student of the University for a full year immediately before his nomination, must be a student of the University at the time of his nomination, and must pledge himself not to hold any position of emolument whilst holding the scholarship without special permission from the Commissioners. He is recommended to the Commissioners by the Senate of the University. The scholarship will be tenable ordinarily for two years and in cases of exceptional merit for three years. The scholar will, in the absence of special circumstances, be required

to proceed to a country other than that in which he received his scientific training, and there pursue some investigation likely to promote technical industries or scientific culture. The particular investigation the student proposes to pursue must be stated before a scholarship can be awarded.

Students of the Faculty of Applied Science are eligible for this scholarship.

Recommendations must be received at the office of the Commissioners before June 1.

The following Science Research scholars have been appointed from Queen's University:

1894, N. R. Carmichael; 1896, T. L. Walker; 1898, F. J. Pope; 1900, W. C. Baker; 1901, C. W. Dickson; 1904, C. W. Knight; 1905, F. H. McDougall; 1907, C. Laidlaw; 1909, N. L. Bowen; 1911, W. A. Bell; 1913, J. R. Tuttle; 1915, R. C. Cantelo; 1921, D. G. H. Wright; 1924, R. H. F. Manske; 1924, D. C. Rose; 1926, H. M. Cave; 1928, B. W. Sargent; 1931, E. H. Charlesworth; 1932, G. S. Farnham; 1932, W. J. Henderson; 1934, W. E. Bennett; 1935, J. S. Marshall; 1937, A. G. Ward.

This Scholarship will not be awarded again until after the war.

The Rhodes Scholarship

1. *General Regulations*:—A Rhodes Scholarship is tenable at the University of Oxford and may be held for three years. Since, however, the majority of Rhodes Scholars obtain standing which enables them to take a degree in two years, appointments are made for two years in the first instance, and a Rhodes Scholar who may wish to remain for a third year will be expected to present a definite plan of study for that period satisfactory to his College and to the Rhodes Trustees.

Rhodes Scholars may be allowed, if the conditions are approved by their own College and by the Oxford Secretary to the Rhodes Trustees, either to postpone their third year, returning to Oxford for it after a period of work in their own countries, or may spend their third year in postgraduate work at any university of Great Britain, and in special cases at any university on the continent of Europe, the overseas dominions, or in the United States, but not in the country of their origin.

The stipend of a Rhodes Scholar is fixed at £400 per year. At most Colleges, and for most men, this sum is not sufficient to meet a Rhodes Scholar's necessary expenses for Term-time and Vacations, and Scholars who can afford to supplement it by £50 per year from their own resources will find it advantageous to do so.

2. *Conditions of Eligibility*:—A candidate to be eligible must:

1. Be a British subject, with at least five years' domicile in Canada, and unmarried. He must have passed his nineteenth year, but not have passed his twenty-fifth birthday on October 1st of the year *for* which he is elected.

2. Have reached such a stage in his course at one of the Universities in Canada that he will have completed at least two years at the university in question by October 1st of the year *for* which he is elected.

Candidates may apply either for the province in which they have their ordinary private domicile, home or residence, or for any province in which they have received at least two years of their college education before applying.

In that section of the Will in which he defined the general type of scholar he desired, Mr. Rhodes wrote as follows:

"My desire being that the students who shall be elected to the scholarships shall not be merely bookworms, I direct that in the election of a student to a Scholarship regard shall be had to:

1. his literary and scholastic attainments;

2. his fondness for and success in manly outdoor sports such as cricket, football and the like;

3. his qualities of manhood, truth, courage, devotion to duty, sympathy for and protection of the weak, kindliness, unselfishness and fellowship, and

4. his exhibitions during school days of moral force of character and of instincts to lead and to take an interest in his schoolmates for those latter attributes will be likely in after life to guide him to esteem the performance of public duty his highest aim."

Full particulars may be obtained from D. R. Michener, 372 Bay St., Toronto, Secretary of the Selection Committee for the Province of Ontario. Two Scholarships may be awarded annually in the provinces of Quebec and Ontario if qualified candidates appear.

Each candidate for a Scholarship is required to make application to the Secretary of the Committee of Selection of the Province in which he wishes to compete, not later than November 10th. Application forms may be obtained from the Registrar's Office.

The following graduates of Queen's University have been awarded Rhodes Scholarships:

1905, J. M. Macdonnell; 1906, A. G. Cameron; 1907, N. S. Macdonnell; 1911, S. Scott; 1912, H. S. Smith; 1914, A. G. Cumming; 1919, H. R. MacCallum; 1920, K. E. Taylor; 1922, A. D. Winspear; 1925, L. F. Kindle; 1926, D. A. Skelton; 1936, J. G. Davoud; 1937, G. M. Brown; 1938, G. P. Grant; 1941, G. S. Bowell; 1941, R. S. Rettie.

This Scholarship is not controlled by the University.

III.—SCHOLARSHIPS AND PRIZES

Scholarships are tenable in the session following award. By special permission of Faculty, the recipient of a Scholarship, available in the third and fourth years of his course, may postpone the use of the Scholarship for

one year in order to engage in practical work connected with his chosen profession.

Scholarships and prizes are awarded on the standing obtained by a student on a regular year of work. A student who is repeating his year, or who fails in a class in the current year is not eligible.

An undergraduate student may not hold more than two Faculty Scholarships, or receive more than $300 in scholarship money in any one year.

These Scholarships may be held only by students who register in the Faculty of Applied Science in the year following the award.

SCHOLARSHIPS FOR AWARD IN FIRST YEAR

University Scholarships*

Some Scholarships of the value of $100, and some of the value of $75, will be awarded to students in the first year, on the basis of standing obtained in all subjects having examinations, namely, English, Mathematics, Chemistry, Physics, and Surveying.

William Coombs Baker Memorial Prize

A prize of the value of about $22 in books selected from a list approved by the Department of Physics. This prize has been founded by graduates in memory of William Coombs Baker, formerly the Robert Waddell Professor of Experimental Physics at Queen's University. Awarded annually to the student making the highest standing in Physics I.

Robert Bruce Scholarships

Under provisions of the will of the late Robert Bruce of Quebec the University has established a Scholarship worth about $70 in each of the Faculties of Arts, Applied Science, and Medicine. Until 1948 the award is limited to students of Scottish extraction.

The Scholarship in each Faculty will be awarded at the end of the first year to the student who has made the highest standing on the regular examinations of that year. One third of the value of each scholarship will be paid to the winner in each of the second, third, and fourth years of his Course provided that he is in attendance in the Faculty in which the award was made.

The N. F. Dupuis Scholarship

Value $50. Founded by the graduates as a mark of their appreciation of the long and effective services of Dr. N. F. Dupuis, as Dean of the Faculty of Applied Science and Professor of Mathematics. Awarded to the student who makes the highest marks in Mathematics of the first year at the April Examinations.

The Dr. William Moffat Scholarship

Value $20. Founded by Dr. William Moffat, of Utica, N.Y. Awarded annually to the student making the highest standing in first year chemistry. The award will be made on combined results of class work and examination.

* One of these scholarships is maintained by the Class of Science '41 in memory of Mr. J. O. Watts, lecturer in the Department of Mathematics, 1931-1941.

Roberta McCulloch Scholarships in English

Founded by the late Andrew McCulloch, M.A., of Thorold.

1. Value $40: awarded annually to the student standing first in Science English.

2. Value $30: awarded annually to the student standing second in Science English.

William Wallace Near Scholarship

Value $100. Established under provisions of the will of the late William Wallace Near of Toronto. To be awarded to the student in the first year who has the highest average on all the work of the year.

Pipe Band Scholarship

Value $25. Maintained by the Queen's University Pipe Band. Awarded annually to the best piper among first year students in all faculties on the basis of a piping contest.

SCHOLARSHIPS FOR AWARD IN SECOND YEAR

University Scholarships*

A number of scholarships of the value of $100 each will be awarded in Sections ABCDM and EFG in proportion to the registration in these Sections, on the basis of the returns in all subjects in which examinations are written, that is, in all subjects except Drawing and Shop Work.

The Alexander Macphail Scholarship

Value $100. Founded by the members of Science '14. Awarded to a student in Section EFG on the basis of the returns in all subjects in which examinations are written.

The W. P. Wilgar Memorial Scholarship

Value $100. Founded by members of the Classes of Science '03-'16 and other friends of the late Professor W. P. Wilgar, B.Sc. '03. Awarded to a student in Section EFG on the basis of the returns in all subjects in which examinations are written.

Scholarship of the Association of Professional Engineers, No. I

Value $100. Founded by the Association of Professional Engineers of Ontario. Awarded in alternate years to the student in Courses ABCDM and EFG who makes the highest average on the work of the second year. To be awarded to a student in EFG in 1943-44.

Scholarship of the Association of Professional Engineers, No. II

Value $75. Awarded by the Association of Professional Engineers of Ontario. Awarded in alternate years to the student in Courses ABCDM and EFG who makes the highest average on the work of the second year. To be awarded to a student in ABCDM in 1943-44.

Mowat Scholarship

Value $40. Founded by the late John McDonald Mowat, B.A., '95. Awarded to the student in the Faculty of Applied Science who obtains the highest average on the examinations at the end of the second year.

* One of these scholarships is maintained by the Class of Science '42 in memory of one of their members, Harry G. Beaty, who was killed on active service on July 30th, 1941; one is maintained by the Class of Science '43 in memory of one of their members, Donald J. Sterling, who was killed on active service on July 7th, 1942.

William Wallace Near Scholarship

Value $100. Established under the provisions of the will of the late William Wallace Near of Toronto. To be awarded to the student in the second year who has the highest average on all the work of the year.

Dr. William H. Nichols Scholarship in Chemistry

Founded by Dr. William H. Nichols.

A Scholarship of the value of $40 will be awarded to the student obtaining the highest marks during the year in Qualitative Analysis I.

The P. D. Ross Scholarships

Two scholarships of the value of $100 and $50 respectively. These scholarships are awarded annually to the students obtaining highest and second highest standing in the subjects common to the courses of the second year.

Science '11 Scholarship

Value $20. Awarded in the Faculty of Applied Science to the student with the highest average standing in the term work and examinations of the second year.

SCHOLARSHIPS AND PRIZES FOR AWARD IN THIRD YEAR

The Joseph Abramsky Scholarship in Mechanical Engineering

Value $50. Founded by his sons in memory of the late Joseph Abramsky. Awarded to the student in the Faculty of Applied Science who obtains highest standing in Mechanical Engineering during his third year.

J. J. Denny Memorial Scholarship

Value $100. Founded by members of the Class of Science '03-'06 and other friends of the late James J. Denny, M.Sc. '21. To be awarded upon entrance to the third year of the Course in Mining or Metallurgy, to the student, who, in the judgment of the Faculty of Applied Science, is most worthy of the award.

The Manley B. Baker Scholarships in Geology

Founded by Agnes Moreland Baker. Two Scholarships of the value of $125 and $75 will be awarded annually to the students in the Faculties of Applied Science or Arts obtaining highest and second highest standing in the first three courses in Geology. These may include Mineralogy 10a (Arts) or Mineralogy III (Science). If two students are equal preference will be given to the one whose need is greater.

The Kenneth B. Carruthers Scholarships in Mining and Metallurgy

Value $110 each. Founded in memory of Major Kenneth B. Carruthers, B.Sc., who was killed at Passchendaele in October, 1917. Two scholarships are awarded annually on the results of third year work, one to the student in Mining Engineering (Course A) and the other to the student in Metallurgical Engineering (Course M) making the highest standing on the whole year's work.

Isaac Cohen Scholarship in Electrical Engineering

Value $100. Awarded to the student in the Faculty of Applied Science who has obtained at the end of his third year the highest standing in the following subjects: Hydraulics I, Mechanical Engineering I, Electrical Engineering II and III, Physics V, and Mathematics VII.

Reuben Wells Leonard Penultimate Year Scholarships

One Scholarship of the value of $300 and one of the value of $200. Awarded at the end of the penultimate year to the students obtaining highest and second highest standing respectively. The winning students must be in residence the year following the award.

Susan Near Scholarships

Five scholarships of the value of $100 each. Established under the provisions of the will of the late Susan Near of Toronto. To be awarded at the end of the third year by Departments in proportion to the number of students in each Department. The exact distribution of scholarships will be announced at the beginning of each session. Eligibility for one of these scholarships requires an average of at least 66% on the work of the third year with no failures.

William Wallace Near Scholarships

Three scholarships of the value of $100 each. Established under the provisions of the will of the late William Wallace Near of Toronto. To be awarded at the end of the third year to the best students in each of the three Courses, Chemistry, Chemical Engineering, and Civil Engineering. Eligibility for one of these scholarships requires an average of at least 66% on the work of the third year with no failures.

Scholarships of the Association of Professional Engineers

Three scholarships of the value of $100, $75, and $50. Founded by the Association of Professional Engineers of Ontario. Awarded to students in any branch of engineering with the highest average on the examinations of the third year.

Engineering Institute of Canada Prize

Value $25. Awarded by the Engineering Institute of Canada to the student in any department of engineering, who, in the year prior to his graduating year, has proved himself most deserving, as disclosed by the examination results of the year in combination with his activities in the students' engineering organization, or with a local branch of a recognized engineering society.

Fifth Field Company Scholarship

Value $40. The Fifth Field Company Scholarship is provided by funds accumulated for this purpose by the officers, N.C.O.'s and sappers of that unit since the war, and is given to the student of the third year in courses E, F or G who makes the highest standing in Hydraulic Engineering I.

PRIZES FOR AWARD IN FOURTH YEAR

The L. M. Arkley Prize

Value $40. This is a prize founded by the Scots Run Fuel Corporation of Morgantown, W. Va., in recognition of Professor Arkley's interest in the

proper methods of purchasing, analyzing and burning coal. To be awarded to the fourth year student in Mechanical Engineering who gives evidence that he understands the sampling and analyzing of coal and submits, before April 1st of each year, the best paper on the phase of the subject assigned.

The E. T. Sterne Prize in Chemical Engineering

Value $25. To be awarded to a student in Chemical Engineering after finishing his third year, for the best essay describing his summer's work. Essays to be handed in by December 31st. The donor desires that emphasis be laid on a discussion of the theoretical principles in Chemistry and Physics underlying any one of the manufacturing processes described.

GENERAL SCHOLARSHIPS AND PRIZES

The Alexander MacLachlan Peace Prize

The Alexander MacLachlan Peace Prize has been established by the MacLachlan family in memory of Alexander MacLachlan, former President of International College, Smyrna, who throughout his life worked for a better understanding among nations.

Value $30. Awarded annually for the best essay of 3,000 words on the subject *Promotion of Enduring World Peace.* The prize is open to all undergraduates of Queen's University, both intramural and extramural. The essay must be clearly written or typewritten, and must be sent in to the Registrar's Office on or before March 1st, accompanied by a statement signed by the candidate that the essay is the result of his own reading, thinking, and discussion and that he has not been assisted by other students in writing it.

B'nai B'rith Kingston, Bursary

Value $50. Founded by the B'nai B'rith Lodge of Kingston.

This Bursary will be awarded annually to a student of promising ability but straitened circumstances. The award will be made on the basis of the April examinations. Applications will be received by the Registrar up until April 1 of each year.

Prizes of The Canadian Institute of Mining and Metallurgy

Premiums and prizes at the discretion of the Council may be given annually for papers read by student-members of the Institute and affiliated students during the year. Any such award will be made by the Council within three months after the Annual Meeting.

Engineering Society Prizes

The Engineering Society of Queen's University offers two prizes of $15.00 and $10.00 for the two best papers on scientific subjects, by members of the society. These papers must be read before the society, and five papers, at least, must be presented before the prizes will be awarded. These prizes are open for competition to all students of Engineering.

Khaki University and Y.M.C.A. Memorial Fund

This fund is part of a sum, left from the Khaki University after the War, which was divided among the Canadian Universities.

The interest, amounting to $240, will be used to award one or more scholarships open to undergraduate students in any Faculty. In awarding these

scholarships the need as well as the standing of applicants will be considered and preference will be given to returned men, or sons or daughters of soldiers of the Great War. Applications will be received by the Registrar up to April 1st.

Reuben Wells Leonard Special Scholarships

Special Reuben Wells Leonard Scholarships for merit and need will be awarded in varying amounts to students of promising ability but straitened circumstances. The awards will be made on a loan or service basis.

George J. MacKay Prize in Metallurgy

Value $25. A prize given by the Mining and Metallurgical Society of Queen's University in memory of Professor George J. MacKay, formerly Head of the Department of Metallurgy at Queen's University. This prize will be awarded annually for seven years to the student in any year who submits, by February 1st, the best essay dealing with some branch of Metallurgy.

The A. E. Segsworth Prize.

Value $40. This is a prize founded by R. F. Segsworth, Esq., Toronto, in memory of his brother, A. E. Segsworth, B.A., Ph.D. The prize is awarded to the student of any year who hands in before December 1st the best account of his previous summer's experience in practical underground mining.

The O. M. Montgomery Memorial Fund

Established by the Aluminum Company of Canada in memory of Mr. O. M. Montgomery, who graduated from Queen's University in Electrical Engineering in 1905. This Fund will be used to provide bursaries for worthy students in need of financial help. It will be administered by a Committee consisting of the Principal, the Vice-Principal, the Registrar, and a representative of the Aluminum Company. Awards may be made in any Faculty, and may only be regarded as gifts at the discretion of the Committee when made to sons or daughters of employees of the Aluminum Company. Otherwise repayment is expected in one or both of the various ways:

(1) By service to the University if the beneficiary has time and is qualified for the work available. Such service shall be assistance in a department, or office, or library, or laboratory, or some other comparable employment.

(2) By return in cash of the sum granted, or of the part not worked out. In such case the award is regarded as a loan without interest, payable at some convenient time to be agreed upon.

Prize of Society of Chemical Industry

Value $25. The Society of Chemical Industry offers an annual prize of $25 to be awarded to the undergraduate student in any branch of chemistry who presents a paper on his summer's work, or on any other chemical subject which he may select. This paper may be a thesis or paper required in his

regular work of the year. The work or subject treated must relate to some branch of chemistry. Essays must be submitted not later than February 28th to the Secretary of the Ottawa Section of the Society of Chemical Industry. The successful competitor will be called upon to read his winning essay at a regular meeting of the Ottawa Section of the Society.

C.O.T.C. Scholarship

Value $100. Maintained by the regimental funds of the Queen's University Contingent of the Canadian Officers' Training Corps. To be awarded annually to a member of the Contingent who is not an officer. The selection will be made by the Committee on Military Education from a group recommended by the Commanding Officer. In determining the award academic standing will be taken into consideration.

American Legion Scholarship

Value $100. Established by Dr. George Hayunga of New York.

To be awarded annually to a student officer of the Queen's University Contingent of the Canadian Officers' Training Corps, the selection to be made by the Committee on Military Education from a group nominated by the Commanding Officer. In determining the award academic standing will be taken into consideration. If the winning student is in his final year the scholarship will be awarded as a prize.

IV.—THE DOUGLAS TUTORSHIPS

At the beginning of session 1910-1911 a gift from Dr. James Douglas, of New York, led to the establishment of a system by which first year students were tutored by men selected from the senior years. The instruction is given out of class hours and as each tutor gives his whole attention to not more than five students in a period, the result is that of individual teaching.

REGULATIONS

N.B.—Students taking the regular course are subject to all Rules and Regulations immediately upon publication, unless otherwise specified.

1. The Faculty may at any time, either during the term, or after the close of the term, require any student to withdraw whose conduct, attendance, work or progress is deemed unsatisfactory.

2. Registration.—Students of the first year must register and pay fees on the day before the opening of session. Students of other years will register and pay fees on the first day of session. A student who fails to register at the prescribed time must pay an additional fee of $3.00 on the first day with $1.00 for each day after that date, unless granted exemption by the Faculty. No student proceeding to a degree will be allowed to register after the tenth day except by special permission of the Faculty. *Permission must be obtained before the opening of session.*

A student entering the Faculty of Applied Science for the first time must submit a certificate showing successful vaccination.

3. Attendance.—Students are required to attend seven-eighths of their class lectures before permission will be given to write the examinations, and seven-eights of their laboratory hours before their laboratory work will be certified. Exemption from this rule can be obtained only on application to the Faculty. All absences for whatever cause, including illness or late registration, must not exceed one-eighth of the total number of hours of work required in any subject.

4. Courses.—All students must take the subjects required in their courses in conformity with the calendars of their year of attendance. If a student wishes to change his course, he must first obtain the permission of the Faculty.

5. Sessional Examinations.—Sessional examinations are held in all the subjects prescribed in the various courses. Fifty per cent. is required in each subject for pass standing. In determining a student's standing at a sessional examination, professors are empowered to take into account his entire class record.

Students must take the April examinations in all classes in which they are registered. If they fail in more than four classes including practical classes in which no written examinations are held, they are regarded as having lost their year.

Students who fail in not more than four classes may write supplemental examinations in the following September. The pass mark for supplemental examinations is fifty-five per cent. Students who fail in more than one supplemental must repeat the year. Students who twice fail a year are required to withdraw.

A student may not enter the third year until he has passed all the examinations of the first year; or the fourth year until he has passed all the examinations of the second year. Surveying Field Work I is regarded as a second year class and comes under this regulation both in respect to back classes and to admission to the fourth year. A student who is debarred from entering the third year because of back classes in the first year, or from entering the fourth year because of back classes in the second year, will not be allowed to write subsequent examinations in these classes without special permission from the Faculty.

6. Repeaters.—No student may repeat more than one year of his course except by special permission of the Faculty.

7. Mid-Term Examinations.—Examinations are held for all first year students about the middle of the Autumn term in the regular class hours.

8. Mid-Session Examinations.—Two hour examinations in all subjects are held for first and second year students the week before the Christmas vacation. A student repeating his first year who fails in four or more of these examinations will be required to withdraw from the faculty. A student repeating

his second year who fails in more than four subjects will be required to withdraw. A proper proportion of fees paid will be refunded. The attention of all students is called to Regulation No. 1.

Final examinations are held at the beginning of the second term in all subjects in which the instruction terminates at that time. No other papers are set in these subjects until the following September.

9. Supplemental Examinations.—Unless specially excused by the Faculty upon application received at the Registrar's office before July 15th, all students who fail in one or more subjects of their year up to a total of four must write supplemental examinations in all such subjects in September of the same year, as a condition of admission to the next higher year of their course.

A student who has one failure in the April examinations of his final year must write off this class by the following April.

A student who has not been registered in the session in which he wishes to take any supplemental examinations must pay the registration fee of $10 in addition to the examination fee.

Students may take supplemental examinations at approved outside centres if application is made by July 15th to the Registrar.

10. Penalty For Failure To Write.—If a student fails to write an examination from which he has not been excused by the Faculty, a penalty of $10 is charged. The student must pay in addition the regular supplemental examination fee of $10.00.

11. Practical Work.—Students are required to take the practical courses given in the calendar unless they have followed similar courses in other educational institutions, but instructors may, at their discretion, modify the work for students who have had experience in the field, in engineering works, etc. Such students may be set immediately at more advanced work than that required of those who have not had such experience.

12. Excursions.—The excursions are compulsory for all fourth year students in courses A, D, M, E, F, and G, and third year students in courses A, B, and M.

13. Vacation Work.—Before applying for a degree a candidate is required to submit certificates of having had at least six months' employment of a nature, that in the opinion of the departments concerned, shall have given him suitable experience in the practice of his profession.

14. Graduation.—Application for degree must be made before March 15 on forms which may be obtained from the Registrar.

GENERAL INFORMATION

EXPENSES

The following statement of expenses for a session in normal times is compiled from information obtained from students who have kept an account of their expenditures. Personal expenses are not included in the estimate.

Class, Hospital, Athletic and other fees	$255.00		$255.00
Board, lodging and laundry	275.00	to	325.00
Books and Stationery	35.00	to	45.00
Excursions, Field and Technical	15.00	to	45.00
	$580.00	to	$670.00

The average student pays for board from $6.00 to $6.50 a week; and for a room $3.00 to $4.00 a week. A few pay as little as $8.00 for board and room; while others, with more expensive tastes, pay over $10.00. Any student, however, may count on finding satisfactory board and lodging at from $9.00 to $9.50 a week.

Lists of Boarding Houses for men students may be obtained from the Registrar. Meals may be obtained at the cafeteria in the Students' Union.

PHYSICAL WELFARE OF STUDENTS

Every student is required upon registration to contribute $4 towards a health insurance fund. In return the student has the free services of the University medical officer and a special hospital rate of fifty cents a day. Details of the plan are given in a printed leaflet which may be had on request.

All students in their first year are required to take physical training for two hours a week, unless excused on account of military training. They are examined by the University physician, who prescribes proper exercises to correct any physical defects.

VACCINATION

Every student registering for the first time must submit evidence of successful vaccination.

TUBERCULIN TESTS

Tuberculin tests will be given to all students entering Queen's University for the first time in September 1943. This service will be free of charge but those who react positively are expected to have an X-ray examination at their own cost.

STUDENT SELF-GOVERNMENT

Queen's was the first University in Canada to introduce student self-government. All students are members of the Alma Mater Society, the chief instrument of student government, and are expected to share in its duties and responsibilities.

ALMA MATER SOCIETY LECTURE

In 1939, as a contribution from the student body to the Centenary Endowment Fund, the Alma Mater Society gave the University its accumulated reserve of $1711. The income will be used to provide an annual lecture to be known as the Alma Mater Society Lecture.

MILITARY SERVICES

University Naval Training Division

The University Naval Training Division, Queen's University, was organized in March 1943, under the direction of Lieutenant S. T. Hill, Commanding Officer H.M.C.S. "Cataraqui."

A minimum of 110 hours' training will be given during the academic year, and two weeks' spring training in H.M.C.S. "Cornwallis" or H.M.C.S. "Naden" at the end of the academic year.

Under-graduates in science or non-science courses will be enrolled as ratings on Divisional Strength. Students in mechanical, electrical engineering and engineering physics courses will be enrolled as Stokers II. Students in other University courses, except Medicine, will be enrolled as Ordinary Seamen. Students who fail to pass the medical examination for Ordinary Seamen may be considered for other rates still being recruited.

Canadian Officers' Training Corps

The Queen's University Contingent of the C.O.T.C., formed at the outbreak of the last war under Lieutenant-Colonel A. B. Cunningham, was organized as a Unit of the Militia in February, 1915. Reorganized after the war by Colonel A. Macphail, C.M.G., D.S.O., it is now commanded by Lieutenant-Colonel R. O. Earl, E.D.

Basic military training is provided for students in all faculties of the University.

University Air Training Corps

The Royal Canadian Air Force has established a University Air Training Corps, with squadrons in the various Canadian universities and colleges. The Queen's University unit is known as No. 4 Squadron. In a two-year course, instruction is offered equivalent to that of an R.C.A.F. Initial Training School, comprising drill, mathematics, navigation, signals, airmanship, aircraft recognition, visits to service flying stations and familiarization flights. At the end of each academic session, U.A.T.C. airmen attend camp for two weeks at an R.C.A.F. station.

No. 4 (Queen's University) Squadron is under the command of Squadron Leader H. L. Tracy.

EMPLOYMENT SERVICE

An Employment Service has been in successful operation at the University for several years. It is under the jurisdiction of the Service Control Committee of the Engineering Society and administered by the Secretary of the General Alumni Association. It is financed by the Engineering Society and the University. The objects of the Service are to assist graduates in all Faculties to secure suitable positions, and to help students to obtain work during vacation periods.

Communications should be addressed: Manager, Employment Service, Queen's University.

FRATERNITIES

By resolution of Senate no student registered with the University may form or become a member of any chapter of any externally-affiliated fraternity or sorority at or near Kingston.

THE STUDENTS' MEMORIAL UNION

The Students' Memorial Union was built to commemorate the service of the students and graduates of Queen's in the Great War.

Every male student is a member of the Union, which is really a club, where the men of all Faculties may meet in a University building designed for that particular purpose and privilege.

There are the usual club facilities, dining room, lounge, billiard room, reading room and committee rooms.

FEES

SESSIONAL FEES (including registration, tuition, examination, degree, library, laboratory, health insurance and student interests. The fee for athletics, which is part of student interests, gives admission to all home games except play-offs) :—

If paid on registration $255.00

If paid in instalments:

1st payment, on registration $144.00

2nd payment, on or before Jan. 6 .....$116.00

Fees may be paid in two instalments, in which case an additional $5 will be added to the first instalment. The first instalment and the laboratory deposit must be paid at the time of registration in September, the balance on or before January 6th, 1944. No student will be admitted to classes until the above conditions have been complied with, nor will he be permitted to continue the work of the second term until the fees have been paid in full.

Fees must be remitted by accepted cheque, postal order, or bank draft, payable to Queen's University. Cheques or bank drafts on any point where there is a branch of the Bank of Montreal will be received at par; all other cheques should have ⅛ of 1%, minimum 15c, added to cover exchange, or drawn plus exchange.

FIFTH YEAR IN COMMERCE.

If paid in full on registration $150.00

Student Interests .....$ 23.00

This includes all sessional fees.

(This year is taken in the Faculty of Arts under regulations of that Faculty.)

DEPOSITS.—For covering expenses of breakages, etc., a first year student must deposit $10 with the Treasurer. If at any time the amount of breakages, etc., exceeds $3, an additional deposit of $5 must be made.

For second, third and fourth years the deposit is $5 except in the following courses :—

Second Year Courses A, B, C, D, M $10.00

Third Year Courses A and M 10.00

Third Year Courses B and D 15.00

Fourth Year Course B 15.00

Charges will be made for the use of platinum, and other expensive chemicals and apparatus. All money to the credit of the depositors will be returned at the end of the session on presentation of the deposit receipt properly certified.

The fees below are payable as they are incurred.

Special Charges.

Pro tanto allowance of courses	$10.00
Late registration. See Regulation 2	3.00
Supplemental Examination, one subject	10.00
Each additional subject	2.00
Writing at outside centre in April (if permitted), each paper	5.00
Late application for supplemental examination or graduation	3.00
Special fee for Surveying Field Course	15.00

Fees for Single Classes.

Registration	10.00
Student Interests	23.00
Any course of lectures (limited to five courses)	30.00
Drawing, One Course, per Session	20.00
Surveying, One Course, per Session	20.00
Assaying Laboratory, per Session	10.00
Chemical Laboratory, per Session	20.00
Petrographical Laboratory, per Session	10.00
Mechanical, Electrical or General Engineering Laboratory, per Session	20.00

A student not paying full fees who wishes to take for credit any course not required in his degree prescription must obtain permission to do so from the Departments concerned and must pay the fees for extra classes as laid down in the Calendar.

Fees for M.Sc. Work

*Total Sessional Fee (including laboratory fee, and student interests)	$143.00
Laboratory deposit	10.00

Additional charges may be made in the case of students requiring special material and apparatus.

*If a student decides to spread his work over two years, he will pay each year $87.50 for total sessional fee, and $10 for laboratory deposit.

In addition to regular examination fees, supplemental or otherwise, there will be the following fees for special examinations:

Examination in one paper	$ 5.00
Examination in two or more papers	10.00

Graduation and Other Fees

No graduation fee is charged for B.Sc. unless the degree is taken in absentia, in which case there is a charge of $10.00.

Graduation M.Sc.	$20.00

DEGREES

I. Bachelor of Science.

1. The degree of B.Sc. will be given on the satisfactory completion of a four years' course in any one of the following departments:—

A—Mining Engineering; B—Chemistry; C—Mineralogy and Geology; D—Chemical Engineering; M—Metallurgical Engineering; E—Civil Engineering; F—Mechanical Engineering; G—Electrical Engineering; H—Physics.

A graduate in any course who desires to take the degree of B.Sc. in any other course, or a student desiring to change from one course to another, shall take all the classes which he has not already passed in that course or by examination satisfy the Department in charge of those classes as to his knowledge of the subjects involved.

Graduation with Honours.—Honour standing will be given to any student who graduates with an average of seventy-five per cent. or upwards on the full work of the fourth year of his course. Credit for Honour standing will be given on the diploma, and in the list of graduates a mark of distinction will be placed against the names of those graduating with Honour standing.

The following percentages are required for standing in all courses: Division I—75% and over; Division II—62% to 74%; Division III—50% to 61%.

2. The degrees of B.A. and B.Sc. will be given on the satisfactory completion of a seven years' course in Arts and Applied Science. See pages 63-64.

A candidate for graduation must have completed either a four or a seven years' course and have passed all the required examinations.

II. Master of Science

The Degree of Master of Science (M.Sc.) is granted to candidates who have graduated with the B.Sc. degree and thereafter have been in attendance in the Faculty of Applied Science for at least one full session.

The work prescribed consists of two parts, as follows:

A. Research and Thesis representing not less than half the session's work. Except by special permission the thesis must be submitted by April 20. A candidate who is allowed to postpone his thesis must submit it by September 20 if he desires a degree in the fall.

B. One or both of the following which must be cognate to the field of study and tested by examinations:

(a) Prescribed lecture courses. These, except by special permission of the Faculty, must be advanced courses (i.e. courses not offered for the B.Sc. degree). If allowed to take an undergraduate course, the candidate must pass a special examination of a standard higher than is exacted from B.Sc. candidates.

(b) Directed special studies with reports.

Written examinations will be set on the lecture courses prescribed and also on the directed special studies and a minimum standing of 66% must be made on each paper.

An oral examination will be given on the subject of the thesis.

Candidates must apply for permission to enter the M.Sc. course at least one week before the opening of the session.

No candidate who has not made an average of 66% in his final year will be accepted for the M.Sc. course except by special recommendation of the Department concerned.

A committee consisting of the Vice-Principal, the Dean, the Head of the Department concerned and the Professor or Instructor, selected to supervise the candidate's work shall report to the Faculty on his fitness to enter the M.Sc. course and recommend to the Faculty the prescribed programme of work. On the recommendation of this committee, the Faculty may decline to accept a candidate with the formal requirement of 66% if because of lack of space, equipment, time or for other reasons the department concerned finds itself unable to conduct the work.

A candidate in full time employment in the University (or elsewhere) will not normally be accepted as a candidate for the M.Sc.

THE INSTITUTION OF CIVIL ENGINEERS OF GREAT BRITAIN

The Council of the Institution of Civil Engineers of Great Britain has recognized the degree of B.Sc. of Queen's University obtained in the departments of Civil, Mechanical and Electrical Engineering as exempting from Sections A and B of the Institution Associate Membership Examination. Graduates in the departments of Mining and Metallurgy are exempt from Section B.

DOMINION LAND SURVEYORS

Revised Statutes Canada Chap. 117 Sec. 22, 1927

Every person who has followed a regular course of study in all the branches of education required for this act for admission as a Dominion Land Surveyor in any college or university where a complete course of theoretical and practical instruction in surveying is organized, and who, after examination, had thereupon received from such college or university a degree attesting to his completion of the said course of instruction, which degree shall be the degree of Bachelor of Science ——— shall be exempt from serving three years as aforesaid as an articled pupil, and shall be entitled to examination for a commission after being admitted upon examination as aforesaid as an articled pupil, and serving one year under articles with a Dominion Land Surveyor including six months' actual service with him in the field. ———

ONTARIO LAND SURVEYORS

Revised Statutes Ontario 1927, Chap. 201, Sec. 28 (1).

The privilege of a shortened term of apprenticeship shall also be accorded to any graduate of the ——— or to any graduate in Civil Engineering or of Mining Engineering ——— of Queen's University at Kingston, and such person shall not be required to pass the preliminary examination for admission to apprenticeship, and shall only be bound to serve under articles with a practicing surveyor, duly filed as required by section 31, during twelve successive months of actual practice after which on complying with all the other requirements he may undergo the examination for admission to practice.

COURSES.

A—Mining Engineering; B—Chemistry; C—Mineralogy and Geology; D—Chemical Engineering; M—Metallurgical Engineering; E—Civil Engineering; F—Mechanical Engineering; G—Electrical Engineering; H—Physics.

First Year, All Courses

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
English	2	0	65
Mathematics I.	2	0	67
Mathematics II.	2	0	67
Mathematics III.	2	0	67
Mathematics IV.	2	0	68
Projection	0	3	125
Physics I & II	4	2	70, 71
Chemistry I. (2)*	3	3	75
Drawing I.	0	3	124
Surveying I.	0	2	111
Physical Training	0	2	126
	17	15	Total 32

Second Year

Courses A, B, C, D, M.

Mathematics V.	3	0	68
Descriptive Geometry	0	2	125
Physics XIV.	3a, 2b	4a, 2b	72
Qualitative Analysis I. (Chem. 10)*	2	6	76
Mineralogy I. (1)*	1a, 2b	2	87
Geology I.	2	0	82
General Engineering I.	2	0	102
Surveying II.	1	3	111
Drawing II.	0	3	124
	14a	20a	Total 34a
	14b	18b	Total 32b

*The No. of the same course given in the Arts Faculty.

Students in Courses A, C and E must take Surveying Field Work. See p. 112.

Courses E, F, G.

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Mathematics V.	3	0	68
Astronomy II.	1	0	69
Descriptive Geometry	0	2	125
Physics III.	2	2	71
Physics IV.	2	2	71
General Chemistry II.	2	0	76
General Engineering I.	2	0	102
Mechanical Engineering IX.	1	2	120
Surveying II.	1	3	111
Drawing III.	0	5a, 3b	125
Shop Work	0	2½	123
	14a	18½a	Total 32½a
	14b	16½b	Total 30½b

Students in Courses A, C and E must take Surveying Field Work. See p. 112.

A.—MINING ENGINEERING.

This course is necessarily a very broad one, so that it may give a foundation for whatever branch of the profession a graduate may enter. Experience has shown that graduates do not usually follow any narrow differentiation which they make during their course, but are governed by many other factors in the practice of Mining Engineering. These factors are often out of their control, and the wisest plan in a four years' course appears to be, not to specialize, but by a broad training in the final years to obtain a suitable introduction to any branch of the work.

There are, however, certain well known avenues towards professional work, such as a good training and a manipulative skill in drafting, chemical analysis, and surveying. These subjects are essential for almost any professional position in mining and metallurgy, and are therefore perfected as far as is possible while at college.

At the present time there are no summer classes, or summer field work in mining or metallurgy. Under these conditions the student can, usually, obtain practical and remunerative work during four or five months each summer. This work, if in connection with Mining, Metallurgy or Surveying is considered to be more useful as a training than practical work under academic supervision.

Visits are paid to mines and smelters. One trip at least is required of each student, the expense not to be more than twenty-five dollars.

First and Second Years

See Page 47.

Third Year

Before entering the third year in Mining Engineering it will be necessary for the student to satisfy the department that he is physically fit for the work he intends to follow. This refers particularly to examination of eyes and chest.

	Lect. Hrs. per week.	Lab. Hrs. per week	Page.
Surveying Field Work	2 weeks course		112
Quantitative Analysis I. (3)*	1	3	78
Mineralogy IV. (11)*	2	2	89
Geology IV.	2a	0	83
Geology III. (b) (10b)*	2b	2b	83
Mining I.	2	2a, 1b	92
Ore Dressing	2a, 1b	0	93
Metallurgy II.	2	0	95
Thermodynamics I.	1	0	121
General Engineering III.	0	2	103
General Engineering V.	1	3	103
Electrical Engineering I.	2	2	114
Fire Assaying	0	4b	97
	15a	14a	Total 29a
	14b	19b	Total 33b

Fourth Year

	Lect. Hrs. per week.	Lab. Hrs. per week	Page.
Mechanical Engineering IV.	2	0	118
Geology V.	1	0	84
Geology VIII. (15)*	2	0	84
Hydraulic Engineering IV.	2	0	107
Metallurgy IV.	3	0	95
Milling	0	9	94
Mining II.	3	2	92
Mining III.	0	3	93
Economics I.	2	0	66
Summer Essay			93
	15	14	Total 29

*The No. of the same course given in the Arts Faculty.

To those students who wish to do further work in Geology the following optional course in the fourth year is offered. Only specially recommended students will be allowed to take this course.

FOURTH YEAR, GEOLOGY OPTION

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Geology II. (11)*	0	2	83
Geology V.	1	0	84
Geology VII.	0	2b	84
Geology VIII. (15)*	2	0	84
Geology X.	0	3	85
Mineralogy II. (10b)*	2b	2b	88
Mineralogy III. (10a)*	2a	2a	88
Mineralogy VI. (14a)*	1a	2a	90
Mining II.	3	0	92
Milling	0	3	94
Metallurgy IV.	3	0	95
Hydraulic Engineering IV.	2	0	107
Mechanical Engineering IV.	2	0	116
Economics I.	2	0	66
Summer Essay			93
	18a	12a	Total 30a
	17b	12b	Total 29b

*The No. of the same course given in the Arts Faculty.

B.—CHEMISTRY (Industrial and Research)

The object of this course is to fit students to enter on graduation upon the practice of the profession of chemistry whether it be exercised in the analytical chemical laboratory, the research laboratory or in the operation and control of chemical industries or other industries in which chemistry plays an important role. It comprises instruction in the principal branches of chemistry as well as fundamental training in mathematics, physics and other closely related sciences. The course is identical in the first two years with that in mining, metallurgical and chemical engineering. In the third year more intensified study of chemistry begins and is continued and developed in the fourth year. In the latter year by the assignment to each student of a minor research problem training is given in methods of research, independent study and the use of the library for investigational work.

First and Second Years—See page 47.

Third Year	Lect. Hrs. per week.	Lab. Hrs. per week	Page.
Quantitative Analysis II. (13)*	2	6a, 10b	79
Industrial Chemistry II. (17)*	2	3	80
Physical Chemistry I. (14)*	2	3	79
Organic Chemistry I. (12)*	2	3	77
General Chemistry III.	2	0	76
Metallurgy II.	2	0	95
Mineralogy III. (10a)*	2a	2a	88
German I.	3	0	65
	17a	17a	Total 34a
	15b	19b	Total 34b

Fourth Year	Lect. Hrs. per week.	Lab. Hrs. per week	Page.
Organic Chemistry II. (22)*	2	6	78
Physical Chemistry II. (25)*	2	3	79
Physical Chemistry III. (24)*	2	3	80
Industrial Chemistry IIIa.	2a	3a	81
Colloid Chemistry II.	2	2a	81
Economics I.	2	0	66
German II.	2	0	66
Option in Chemistry			
General and Inorganic Chemistry IV, Organic Chemistry IV, Quantitative Analysis IV, Physical Chemistry IV or Industrial Chemistry IV.	0	9b	76–81
	14a	17a	Total 31a
	12b	21b	Total 33b

*The No. of the same course given in the Arts Faculty.

C.—MINERALOGY AND GEOLOGY

This course furnishes a foundation for the professions of mineralogy, geological surveying, mining and consulting geology, and is useful for those who will in any way be connected with the discovery or the development of the mineral resources of the country. It forms a good postgraduate course for the mining engineer who wishes to understand thoroughly the groundwork of his profession. Since a knowledge of chemistry is essential for proper comprehension of many mineralogical and geological phenomena, considerable stress is laid on this science in the earlier part of the course. The departments of mineralogy and geology are furnished with well equipped laboratories for the physical and chemical examination of minerals, rocks and ores, and also with collections of illustrative material. Miller Hall has a large museum on the main floor with fine specimens of rocks, minerals, and fossils. Although field excursions are made during the session, students are advised to spend the summer vacations in practical field work.

First and Second Years

See Page 47.

Third Year

	Lect. Hrs. per week.	Lab. Hrs. per week	Page.
Surveying Field Work	2 weeks course		112
Quantitative Chemistry I. (3)*	1	3	78
Physical Chemistry I. (14)*	2	3	79
Mineralogy II. (10b)*	2b	2b	88
Mineralogy III. (10a)*	2a	2a	88
Mineralogy IV. (11)*	2	2	89
Geology II. (11)*	2	2	83
Geology III. (10b)*	2b	2b	83
Geology VII.	0	2b	84
Geology X. (17)*	0	4	85
Ore Dressing	1a, 2b	0	93
	10a	16a	Total 26a
	13b	20b	Total 33b

Fourth Year

	Lect. Hrs. per week.	Lab. Hrs. per week	Page.
Mineralogy V. (12)*	2	2	89
Mineralogy VI. (14a)*	1a	2a	90
Geology V.	1	0	84
Geology VI. (13)*	2	2	84
Geology VIII. (15)*	2	0	84
Geology XII. (14a)*	2a	2a	85
Reports	0	4	85
Mining IV.	1	0	93
Fire Assaying	0	4a	97
Economics I.	2	0	66
Research and Thesis	0	6	90
German I.	3	0	65
	16a	22a	Total 38a
	13b	14b	Total 27b

Graduates in Course A or Course C who wish to take further work in Geology and Mineralogy are referred to the graduate courses in Geology, p. 63, and in Mineralogy, p. 90.

*The No. of the same course given in the Arts Faculty.

D—CHEMICAL ENGINEERING

Chemical Engineering is the application of the fundamental principles of Physics, Chemistry, Engineering, and Physical Chemistry, to the construction and operation of Chemical plant. The course must therefore be a broad one and avoid too narrow a specialization. Graduates have been found to enter the most diverse industries.

The first two years are the same as those for the Mining, Metallurgy and Chemistry students. Specialization begins in the third year, more time being devoted to Chemistry, whilst continuing fundamental courses in Mechanical, Civil and Electrical Engineering. Specialization is continued in the fourth year, with additional training in Chemical Engineering, Mechanical Engineering and Applied Thermodynamics.

The course aims at training students for research and operating positions in chemical and allied industries.

Visits are paid to local chemical works and to a number of the largest chemical plants outside of Kingston, attendance being compulsory. The expense of the outside trip in the fourth year does not exceed twenty-two dollars.

First and Second Years

See Page 47.

Third Year

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Quantitative Chemistry I. (3)*	1	3	78
Physical Chemistry I. (14)*	2	3	79
Industrial Chemistry II. (17)*	2	3a, 2b	98
Chemical Engineering I.	2b	0	99
Organic Chemistry I. (12)*	2	3	77
Thermodynamics I.	1	0	121
General Engineering III.	0	2	103
General Engineering V.	1	3	103
Electrical Engineering I.	2	2	114
Mechanical Engineering XII.	1	3b	121
	12a	19a	Total 31a
	14b	21b	Total 35b

Fourth Year

	Lect. Hrs. per week.	Lab. Hrs. per week.		Page.
Physical Chemistry II. (25)*	2	3		79
Colloid Chemistry Ia. (15a)*	1a	2a		81
Chemical Engineering II.	2	3		99
Chemical Engineering III.	2a, 1b	5a, 6b		100
Chemical Engineering IV.	1a, 3b	0		101
Chemical Engineering V.	2	0		101
Thermodynamics III.	2	3a		121
Hydraulic Engineering IV.	2	0		107
Shop Work	0	3b		123
Economics I.	2	0		66
	16a	16a	Total	32a
	16b	15b	Total	31b

*The No. of the same course given in the Arts Faculty.

M—METALLURGICAL ENGINEERING

Metallurgy is divided into chemical metallurgy, the extraction of the metals from their ores and the refining of the metals, and physical metallurgy, the use of the metals and their alloys in the industries. The former requires in students a grounding in inorganic chemistry and its application in metallurgical processes; the latter, a grounding in physics and its application in the study of the constitution of alloys and their physical changes.

The first two years of the course are the same as those in Mining Engineering, Chemical Engineering and Chemistry. The engineering aspect of metallurgical work is to the fore in these preparatory years, and is kept in view during the third and fourth years.

In the third year specialization begins and particular stress is placed on inorganic and physical chemistry and chemical metallurgy. In the fourth year these are continued, while a foundation is laid in physical metallurgy in lecture room and well equipped laboratories.

As far as industrial conditions permit, students are required to work in mills or smelters during their summer vacations. For graduation an essay on some phase of this practical experience is demanded.

First and Second Years

See Page 47.

Third Year

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Quantitative Analysis I. (3)*	1	3	78
Physical Chemistry I. (14)*	2	3	79
Organic Chemistry V.	1	0	77
Thermodynamics I.	1	0	121
Mineralogy VIIa.	2a	0	90
General Engineering III.	0	2	103
General Engineering V.	1	3	103
Electrical Engineering I.	2	2	114
Mechanical Engineering XII.	1	3b	121
Metallurgy II.	2	0	95
Metallurgy III.	0	2	95
Ore Dressing	2a, 1b	0	93
Fire Assaying	0	4a	97
	15a	19a	Total 34a
	12b	18b	Total 30b

Fourth Year

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Physical Chemistry II. (25)*	2	3	79
Mining IV.	1	0	93
Metallurgy IV.	3	0	95
Metallurgy V.	0	1	96
Metallurgy VI.	1b	0	96
Metallurgy VII.	0	2	96
Metallurgy Lab.	0	3	97
Metallography I.	1a	3a	96
Metallography II.	1b	3b	96
Hydraulic Engineering IV.	2	0	107
Milling	0	9	94
Economics I.	2	0	66
Summer Essay	..	..	97
Mineralogy VIa. optional (14a)*	1a	2a	90
	11a	21a	Total 32a
	12b	21b	Total 33b

*The No. of the same course given in the Arts Faculty.

E.—CIVIL ENGINEERING.

The Course in Civil Engineering proceeds from the fundamentals—Mathematics, Physics, Mechanics, Surveying and Draughting — to their application in—Structural, Sanitary, Highway and Hydraulics—which make up the general field of Civil Engineering.

Throughout the Course specially adapted classes in Metallurgy, Geology, Chemistry, Electrical and Mechanical Engineering are added. Attention is given particularly to Economics and English.

First and Second Years

See Pages 47 and 48.

Third Year

	Lect. Hrs. per week.	Lab. Hrs. per week	Page.
Surveying Field Work	2 weeks course		112
Metallurgy I.	1	0	95
Thermodynamics I.	1	0	121
General Engineering II.	1	0	102
General Engineering III.	0	2	103
General Engineering VI.	1a	3a	104
Foundations	1b	3b	104
Structural Engineering I.	2	3	104
Hydraulic Engineering I.	2	0	106
Surveying III.	1a	3a	111
Municipal and Sanitary Engineering I.	2b	3b	108
Railway and Highway Engineering	2	3	107
Electrical Engineering I.	2	2	114
Geology IX.	2	0	84
	15a	16a	Total 31a
	16b	16b	Total 32b

Fourth Year

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Industrial Chemistry I.	1	0	98
General Engineering IV.	0	3a	103
Municipal and Sanitary Engineering II.	1	0	108
Municipal and Sanitary Engineering III.	1	3b	109
Highway Engineering	1	3a	110
Structural Engineering II.	2	5a, 6b	105
Structural Engineering IV.	2a, 1b	5	105
Mechanical Engineering IV.	2	0	118
Hydraulic Engineering II.	2	0	106
Hydraulic Engineering III.	0	3b	106
Economics I.	2	0	66
Engineering Relations	1	0	107
Thesis .	0	0	112
	15a	16a	Total 31a
	14b	17b	Total 31b

F.—MECHANICAL ENGINEERING.

Mechanical Engineering embraces the design, manufacture and operation of all classes of machinery, of power plants and manufacturing plants, as well as the executive management of industries. A four years' course must therefore be broad enough to give the student a thorough training in the fundamental principles, and not merely provide training for one of the many special branches of the profession.

The first two years are devoted to the study of the fundamental subjects of Mathematics, Physics, Chemistry and Mechanics, including experimental work in the various laboratories. Special attention is given to the strength of materials, with practice in testing during the second and third years. The third and fourth year courses include theoretical and applied Thermodynamics, the study of reciprocating steam engines, with their valve gears, governors, etc., the study of steam turbines, and the engineering and economics of steam power-plant design. Courses are also included on Internal Combustion Engines of all types, on Air Compression, Refrigeration and Heating. Instruction is also given in Mechanism, Machine Design, Production Engineering, Shop Work, and the fundamental principles of Electrical Engineering, and in the elements of Aerodynamics and of Aircraft Design and Manufacture.

As part of the above special attention is being paid to the internal combustion engine as applied to aircraft, together with such auxiliaries as superchargers, magnetoes, ignition, and air cooling systems.

Instruction in drawing extends over the four years, and gives a thorough drill in modern drafting-room practice. In the more advanced courses of the fourth year the student is taught how to apply the general principles to the design and operation of special machinery, steam and gas engines, steam boilers and gas producers, and complete power plants; each student is allowed to specialize as far as is practicable. The instruction in the laboratories is intended not only to familiarize the student with standard methods of testing, but also to teach him how to attack original problems.

The fourth year students are kept in touch with manufacturing works in order to familiarize them with the practice of modern power plants and shops.

First and Second Years

See Pages 47 and 48.

Third Year

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Mathematics VI.	2a	0	68
Thermodynamics I.	1	0	121
Thermodynamics V.	2	2	122
General Engineering III.	0	2	103
General Engineering V.	1	3	103
Electrical Engineering IV.	2	2	115
Metallurgy I.	1	0	95
Mechanical Engineering I.	2	0	117
Mechanical Engineering II.	3b	0	118
Mechanical Engineering III.	0	6	118
Shop Work	0	3	123
Hydraulic Engineering I.	2	0	106
	13a	18a	Total 31a
	14b	18b	Total 32b

Fourth Year

Thermodynamics III.	2	3a	121
Thermodynamics IV.	0	3a, 4b	122
Electrical Engineering VII.	2	2	115
Mechanical Engineering V.	3	6a, 3b	119
Mechanical Engineering VI.	2a, 1b	0	119
Mechanical Engineering VIII.	0	3	120
Mechanical Engineering X.	2	0	120
Mechanical Engineering XI.	2	0	120
Hydraulic Engineering II.	2	0	106
Hydraulic Engineering III.	0	3b	106
Metallurgy VIII.	0	2a	96
Economics I.	2	0	66
	17a	19a	Total 36a
	16b	15b	Total 31b

G.—ELECTRICAL ENGINEERING

The instruction in the first two years of the course in Electrical Engineering provides for a thorough training in the fundamental subjects of Mathematics, Physics, Chemistry and Mechanics, including suitable work in the various laboratories. Part of the time is devoted to elementary drawing and shop work. In the third year the work consists of an introduction to the general principles underlying all electrical work together with elementary laboratory work. Considerable time is devoted to the study of Thermodynamics together with more advanced Mathematics and Physics. The fourth year is devoted to the study of the theory and action of the main types of electrical apparatus, the design and operation of central stations, electric lighting, electric railways and power transmission together with a thorough grounding in the principles underlying the electron tube.

An important part of the course consists in solving problems such as are frequently met with in practical work. In this way the student is trained in the application of theory to the solution of practical problems.

Arrangements are made for occasional visits to electrical works.

The whole course is designed to give the student a thorough understanding of the general principles which constitute the basis of all electrical work, together with some knowledge of their practical application. No effort is made to give that intimate knowledge of practical details which experience alone can supply.

Students are advised not to enter Course G unless they have taken a high standing in Physics III, Physics IV, and Mathematics V.

First and Second Years

See Pages 47 and 48.

Third Year

	Lect. Hrs. per week.	Lab. Hrs. per week.	Page.
Mathematics VII.	2	0	69
*Physics V.	1	2	72
Thermodynamics I.	1	0	121
General Engineering III.	0	2	103
*Electrical Engineering II.	2	3	114
*Electrical Engineering III.	3	3	114
Electrical Engineering VI.	2b	0	115
Mechanical Engineering I.	2	0	117
Mechanical Engineering II.	3b	0	118
Mechanical Engineering VII.	0	3	119
Metallurgy I.	1	0	95
Hydraulic Engineering I.	2	0	106
	14a	13a	Total 27a
	19b	13b	Total 32b

*Students must pass these subjects before entering the fourth year.

Fourth Year

	Lect. Hrs. per week.	Lab. Hrs. per week.		Page.
Electrical Engineering V.	4	6		115
Electrical Engineering VIII.	1	3		115
Electrical Engineering IX.	2	3		116
Electrical Engineering X.	1	3		116
Electrical Engineering XI.	1	3		116
Electrical Engineering XII.	2	3		116
Hydraulic Engineering II.	2	0		106
Hydraulic Engineering III.	0	3a		106
Mechanical Engineering IV.	2	0		118
Metallurgy VI.	1b	0		96
Economics I.	2	0		66
	14a	18a	Total	32a
	15b	15b	Total	30b

Power option students must take Electrical Engineering IX and X.

Communication option students must take Electrical Engineering XI and XII.

H.—PHYSICS

This course is designed to fit men for positions as physicists in research laboratories and industries.

The importance of a thorough grounding in the fundamental subjects of Physics, Mathematics, and Chemistry, cannot be over-emphasized, so these subjects form the major part of the course. The engineer's point of view is acquired from the classes of the Faculty of Applied Science, while the breadth of view necessary for a research worker is gained from the advanced theoretical classes in the major subjects of the course.

First Year

See Page 47.

Second Year

The Second Year of Any Course

Third Year

	Lect. Hrs. per week.	Lab. Hrs. per week.		Page
Mathematics VI.	2a	0		68
Mathematics XI. (16b)*	3b	0		69
Physics V.	1	2		72
Physics VI. (10b)*	3b	2b		72
Physics VII. (14a and 13b)*	3a, 2b	2		73
Electrical Engineering II.	2	3		114
Electrical Engineering VI.	2b	0		115
German I.	3	0		65
	11a	7a	Total	18a
	16b	9b	Total	25b

Fourth Year

Mathematics X. (22t)*	2	0		69
Physics IX. (16a and 20b)*	3	0		73
Physics X. (17b)*	3a, 2b	3b		73
Physics XIII.	0	6		74
Electrical Engineering VIII.	1	3		115
Electrical Engineering XI.	1	3		116
Electrical Engineering XII.	2	3		116
German II or French	2	0		66
Economics I.	2	0		66
	16a	15a	Total	31a
	15b	18b	Total	33b

*The No. of the same course given in the Arts Faculty.

COURSE FOR PROSPECTORS

The course for prospectors is designed particularly for returned men, and any others interested, who may wish to acquire a preliminary training in the study of rocks and minerals and the methods of prospecting for ore deposits. The course will consist of eight weeks of instruction and will be offered as soon as a sufficient number of candidates are available. Since it is essential that field trips be made to known mineral localities in the vicinity of Kingston, classes will be held at a time of year when this is possible, preferably from late February to late April. There are no academic requirements for candidates, but attention is called to the physical requirements of anyone wishing to undertake the arduous work of prospecting.

A fee of $75.00 will be charged for each candidate taking the course, at the completion of which a letter certifying to his attendance will be supplied.

Outline of Classes

Chemistry—Lecture-demonstrations in elementary Chemistry

3 hours per week in the first four weeks.

Department of Chemistry.

Mineralogy—The physical properties of common rock and ore minerals, including those of "strategic" importance, their identification, association, use, and valuation. Laboratory work will consist of identification of minerals by physical properties and blow pipe methods. Rock and ore minerals will be studied in groups of associated minerals.

4 hours lectures per week.

6 hours laboratory work per week.

Department of Mineralogy.

Geology—General and Economic. Origin and mode of occurrence of rocks—sedimentary, igneous, and metamorphic; the deformation of rocks, crustal movements, folding, fracturing, faulting, shearing, etc., the geological age column, with special reference to the pre-Cambrian; in economic geology, the principles of space making, space filling, replacement, secondary enrichment, examples of type deposits and their structures; reading and interpretation of geological maps; geology and physiography of Canada; laboratory work.

5 hours lectures per week.

4 hours laboratory work per week.

Department of Geology.

Prospecting—Definitions—requirements, prospecting agreements, suitable districts, methods. Staking in Ontario and other important laws. Staking on location, trenching, sampling, diamond drilling, dip needle prospecting, underground work, preliminary reports, options.

2 hours lectures per week.

Department of Mining.

Assaying—A brief course in assaying gold ores.

5½ hours per week.

Department of Metallurgy.

Mechanical Drawing—The use of drawing instruments and lettering pens. Simple line drawings, tracings of maps. Blue-printing, white printing.

4 hours per week.

Department of Drawing.

Field Trips—Four field trips on Saturdays on which various types of igneous, sedimentary, and metamorphic rocks and mineral deposits of iron, lead, and zinc, mica, barite and feldspar, will be studied.

GRADUATE COURSE IN COMMERCE

A year's course in Commerce for graduates in engineering of Queen's and other universities. The purpose of this course is to aid in preparing engineers for work in the administrative or financial branches of industry.

The year's work will consist of five full courses or their equivalent (in economics and commerce) to be approved by the Department.

For description of Commerce courses, see the Calendar of the School of Commerce and Administration.

GRADUATE COURSE IN GEOLOGY

The establishment of the Miller Memorial Research Chair in Geology has made it possible to give graduate work in Geology.

The courses are planned to give to those men who have graduated in Mining Engineering, Geology option, the additional training in Geology that is needed for those who intend to undertake exploration and development work.

For those who intend to make Geology their profession a year's work satisfactorily completed at Queen's is equivalent to a year's graduate work at other universities and is accepted as such at most of the important graduate schools in Geology. It has the advantage of giving to graduates who intend to practice their profession in Canada an opportunity to study Canadian localities and problems in more detail than is otherwise possible since the collections of material from the important mineral deposits of the Canadian shield are large and fairly complete, and there is also in the vicinity of Kingston the opportunity for field study of Pre-Cambrian rocks.

Graduates in courses A, Geology option, and C in the Faculty of Applied Science at Queen's University and graduates in equivalent courses of other universities may proceed to the M.Sc. degree. (See p. 45.) The courses are open only to graduates.

For outline of courses see page 86.

COMBINED COURSE IN ARTS AND APPLIED SCIENCE, A COURSE LEADING TO THE DEGREES OF B.A. AND B.Sc. IN SEVEN YEARS

Students taking this Course are required to have Arts Matriculation. They will pay full Arts fees for the first three years. In the fourth and fifth years they will register in both Arts and Applied Science but will pay fees in Applied Science only. They will register in the sixth and seventh years in

The Arts regulation in regard to back classes will apply for the first four years,—(see regulation 15, page 80 of the Arts calendar). Students with back the Faculty of Applied Science and will pay fees in the Faculty of Applied Science.

classes in Arts will not be permitted to make up these classes while they are registered in the Faculty of Applied Science.

The courses must be taken in the order in which they are outlined in the calendar.

The degree of Bachelor of Arts will be conferred on candidates who complete five years' work as outlined below, with a minimum standing of fifty per cent. and sixty-two per cent. in half the classes.

First Year

English 1.
French 1 or *German 1 or *Greek 1 or Latin 1.
Mathematics 1.
Physics 1.
Chemistry 1.

**Students who have not matriculated in German or Greek will have to take German A or Greek A before registering in German 1 or Greek 1. In such cases the A course will not count towards the degree.*

Second Year

English 2.
One course not already offered, to be selected from French 1, 2, German 1, 2, Greek 1, 2, Latin 1, 2.
A course in History or Economics or Politics.
Mathematics I (Applied Science).
Physics II (Applied Science).

Third Year

Three courses in Arts to be selected from courses which will not be covered later in Applied Science.
Chemistry I (Applied Science).
Mathematics III (Applied Science).
Mathematics IV (Applied Science).

Fourth Year

Philosophy 1 or 2.
Two courses in Arts to be selected from courses which will not be covered later in Applied Science.
Mathematics II (Applied Science).
Physics I (Applied Science).
Drawing (Applied Science).
Surveying (Applied Science).
Projection (Applied Science).

Fifth Year

The regular second year Science programme. The work of this year includes courses in Mathematics, Physics and Chemistry which will be counted towards a degree in Arts.

Sixth and Seventh Years

The sixth and seventh years are the same as the third and fourth years of the Course leading to the degree of Bachelor of Science.

SUBJECTS OF STUDY

ENGLISH

ASSISTANT PROFESSOR—C. J. VINCENT, A.M., Ph.D.
LECTURER—W. ANGUS, A.M., Ph.D.

FIRST YEAR ENGLISH

This course consists of the writing of weekly compositions and the study of prescribed works by the following authors: Huxley, Butler, Lewis, Wells, Galsworthy, Shaw, Day, etc.

Foerster and Steadman, *Writing and Thinking* (Boston: Houghton Mifflin Company); O. J. Campbell, J. Van Gundy, and Caroline Shrodes, edd. *Patterns For Living* (New York: MacMillan Co.).

Lectures—Sections 1-4, *Monday* and *Wednesday* 8-9.
Sections 5-8, *Monday* and *Wednesday* 1-2.

GERMAN

PROFESSOR—HEINRICH HENEL, Ph.D.

GERMAN I

For third year students in Courses B and H, and fourth year students in Course C.

This course is intended to meet the needs of students who enter the University with little or no knowledge of German. The work comprises a study of elementary German grammar and the reading of easy scientific literature.

Text-books—Hagboldt and Kaufmann, *A Brief Course in German* (Heath); Wild, *An Introduction to Scientific German* (Oxford).

Lectures—Monday, Wednesday and Friday at 4.

Professor Henel.

GERMAN II

For fourth year students in Courses B and H or any Science students.

This course is designed for students who are doing advanced work in chemistry, physics, geology and mineralogy. Prerequisite: Matriculation in German, German A (Arts), or German I.

Text-books—Wizinger, *German Science Readings* (Crofts); Curts, *Readings in Scientific and Technical German* (Holt); Patterson, *German-English Dictionary for Chemists* (Wiley); scientific journals bearing on each student's special field.

Lectures—Tuesday and Thursday at 9.

Professor Henel.

FRENCH

French I.

For prescription, hours and instructors, see the Arts Calendar.

ECONOMICS

Economics I.

Professor—J. C. Cameron, M. Com. (Head of the Industrial Relations Section)

Required of fourth year students in all courses.

This is a business-background course for engineers. The main emphasis is on personnel management.

Assigned Readings.

Lectures—Monday at 9, and one additional hour to be arranged.

Professor Cameron.

MATHEMATICS.

The N. F. Dupuis Professor in Mathematics—J. Matheson, M.A.

Professor—C. F. Gummer, M.A., Ph.D.

Professor—N. Miller, M.A., Ph.D.

Associate Professor—K. P. Johnston, B.A., B.Sc.

Assistant Professor—G. L. Edgett, M.A., Ph.D.

Assistant Professor—I. Halperin, M.A., Ph.D. (on active service*).

Assistants—J. E. Staples, B.A., R. H. Hay, M.Sc., P. T. Demos, B.Sc., N. A. Williams, B.Sc.

An essential part of the student's training in all courses in Mathematics is the training in accurate computation. He should cultivate the habit of care and accuracy in all his numerical work.

MATHEMATICS I

For first year students in all courses.

Trigonometry, to cover spherical trigonometry and a review and extension of the more important parts of plane trigonometry.

Text Book—Rider, *Plane and Spherical Trigonometry* (MacMillan). Sections 1-4, *Tuesday* and *Thursday,* 1-2; Sections 5-8, *Tuesday* and *Thursday,* 9-10.

Messrs. Hay, Demos and Williams.

MATHEMATICS II

For first year students in all courses.

Calculus. A course covering differentiation and the simpler methods of integration with applications to rates, maxima and minima and the finding of areas, volumes, surfaces, fluid pressure, centres of gravity, moments of inertia, etc.

Text Book—Phillips, *Calculus* (John Wiley and Sons).

Sections 1-4, *Tuesday* and *Thursday,* 2-3; Sections 5-8, *Tuesday* and *Thursday,* 10-11.

Professors Miller and Edgett and Mr. Staples.

MATHEMATICS III

For first year students in all courses.

Analytic Geometry. A course in plane analytic geometry.

Text Book—Brink, *Analytic Geometry,* Revised Edition (D. Appleton-Century Co.).

Sections 1-2, *Wednesday* 10-11, *Friday* 3-4; Sections 3-4, *Monday,* 3-4, *Wednesday,* 10-11; Sections 5-8, *Wednesday,* 3-4. *Friday,* 1-2.

Professor Gummer and Mr. Staples.

* Lieutenant, Royal Canadian Artillery.

MATHEMATICS IV.

For first year students in all courses.

SYNTHETIC SOLID GEOMETRY, covering the properties of the principal solid figures, methods and formulae for areas and volumes, etc.

Text Book—Kern and Bland, *Solid Mensuration* (John Wiley and Sons).

ASTRONOMY, including the fundamental principles of the subject, such as the systems of co-ordinates, planetary motion, time, the use of the Nautical Almanac.

Sections 1-4, *Monday* and *Friday,* 10-11; Sections 5-8, *Monday* and *Friday,* 3-4.

Professors Johnston and Edgett.

MATHEMATICS V.

For second year students in all courses.

CALCULUS AND ALGEBRA. This course continues the Calculus of Mathematics II and covers certain important parts of Algebra. It includes, along with their applications, such topics as annuities, curvature, convergence of series, Taylor's series, integration of more difficult forms, and simple differential equations.

Text Book—Phillips, *Calculus* (John Wiley and Sons).

Monday, Wednesday and Friday 11-12.

Professors Gummer, Miller and Edgett.

MATHEMATICS VI.

For third year students in courses F and H.

A continuation of Mathematics V to cover certain topics in analytic solid geometry and in addition, partial differentiation, maxima and minima for functions of several variables, double and triple integration and simple differential equations with applications.

Text Book—Phillips, *Calculus* (John Wiley and Sons).

Wednesday and Friday, 10-11, first term.

Professor Miller.

MATHEMATICS VII.

For third year students in course G.

Mathematics VI and a continuation to include such topics as hyperbolic functions, the catenary, a more detailed study of differential equations, introduction to Fourier series and the use of the complex variable.

Text Book—Miller, *First Course in Differential Equations* (Oxford University Press).

Wednesday and Friday, 10-11.

Professor Miller.

MATHEMATICS X.

For fourth year students in course H.

A course in the Theory of Functions of a Complex Variable.

Text Book—Osgood, *Functions of a Complex Variable* (Stechert). *Wednesday* and *Friday,* 9-10.

Professor Miller.

MATHEMATICS XI.

For third year students in course H.

A course in Differential Equations to include the more important methods of solution of ordinary differential equations, and a brief introduction to partial differential equations.

Text Book—Miller, *First Course in Differential Equations* (Oxford University Press).

Tuesday, Thursday and Saturday, 8-9, second term.

Professor Gummer.

ASTRONOMY II.

For second year students in courses E, F, and G.

Applications of Spherical Trigonometry to Astronomy. The method of least squares.

Sections 1-6, *Saturday,* 10-11; Sections 7-12, *Tuesday,* 10-11.

Professor Johnston.

PHYSICS

Professor—A. L. Clark, B.Sc., Ph.D., F.R.S.C.

The Chown Research Professor—J. A. Gray, B.Sc., D.Sc., O.B.E., F.R.S., F.R.S.C.

The Robert Waddell Professor of Experimental Physics—J. K. Robertson, M.A., F.R.S.C.

Professor—E. Flammer, B.Sc., Ph.D.

Assistant Professors—H. M. Cave, M.A., Ph.D. (on leave of absence*); B. W. Sargent, M.A., Ph.D., F.R.S.C. (on leave of absence*); E. E. Watson, M.Sc., Ph.D.; H. W. Harkness, B.Sc., B.A., M.Sc., Ph.D.

Lecturers—R. H. Hay, M.Sc., R. A. Chipman, Ph.D.

Instructor—A. Vibert Douglas, M.B.E., M.Sc., Ph.D.

Demonstrator—R. A. Burr, B.Sc.

The work in Physics is carried on in lecture and laboratory courses which run parallel to each other. In the lecture room the fundamental principles are developed and applied, experimental demonstrations given and many problems solved. In all classes in Physics weekly exercises are required of students. In the laboratory a large number of experiments are performed. These are designed to train the student in manipulation of apparatus and instruments of precision, to teach him to make accurate measurements and to give practice in properly recording, interpreting and reducing experimental data.

In all the courses in Physics, the work in the laboratories will be counted as a certain percentage of the whole work of the session. In estimating the standing in the laboratory work, both the quantity and quality of the work done will be considered.

Physics I and II, together forming a complete introductory course, are taken by all first year students. The laboratory work of this year is arranged to supplement the lectures in both Physics I and II, and credit for this work is given on the written papers in both subjects. Students in both classes have opportunity for assistance by Douglas Tutors. (See page 38).

PHYSICS I.

Required of all first year students.

Mechanics, Properties of Matter, and Heat.

Lectures—Sections 1-4, *Monday* 11-12, *Thursday* 3-4.
—Sections 5-8, *Monday* 4-5, *Thursday* 8-9.

Professors Watson and Harkness.

* War Research, National Research Council, Ottawa.

PHYSICS II.

Required of all first year students.

A course of lectures of two hours per week on Magnetism, Electricity, Wave Motion, Sound, and Light. These topics are discussed mathematically and illustrated by experiments.

Lectures—Sections 1-4, *Wednesday* and *Friday* at 11.
Sections 5-8, *Wednesday* 4-5, *Friday* 2-3.
Professors Robertson, Cave, and Mr. Hay.

Laboratory—Section 1, *Monday,* 1-3, Section 2, *Monday,* 3-5.
Section 3, *Thursday* 8-10, Section 4, *Thursday* 10-12.
Section 5, *Monday* 8-10, Section 6, *Monday* 10-12.
Section 7, *Thursday* 1-3, Section 8, *Saturday,* 9-11.

PHYSICS III.

This class required of students in the second year in courses E, F, G.

This course of lectures is a continuation of Physics I. A general review of the important fundamental principles of Physics occupies the first few weeks. These are then applied to problems dealing with Motion in a Circle, Simple Harmonic Motion, Composition of Simple Harmonic Motions with applications, Moments of Inertia, Rotation, Friction of Belts, Pivots and Bearings, Oscillations, Centre of Percussion, Elasticity in Stretching, Bending and Twisting, Energy and its Transformations.

The laboratory work, which runs parallel with the lectures, is a continuation of the work of the first year.

Lectures—Monday and Friday, 9-10.
Professor Harkness.

Laboratory—Sections 1-6, *Wednesday,* 1-3; Sections 7-12, *Friday,* 1-3.
Professors Sargent, Watson and Harkness.

PHYSICS IV.

This class which is required of students in the second year in Courses E, F, G, consists of (a) two lectures per week, (b) a laboratory course of two hours per week.

In the lectures, fundamental electrical ideas are discussed, with special emphasis on quantitative relations. Problems are assigned weekly dealing with basic ideas of Electrostatics, Magnetism, Electromagnetism, Electrodynamics, Electromagnetic Induction, and Alternating Currents.

The laboratory course includes a series of experiments designed to train the student in standard electrical measurements, as well as to illustrate work discussed in lectures.

Lectures—Wednesday, 9-10, *Friday,* 8-9. Professor Watson.

Laboratory—Sections 1-4, *Saturday,* 8-10 (a), *Monday,* 1-3 (b); Sections 5-8, *Thursday,* 1-3; Sections 9-12, *Thursday,* 3-5.
Professors Sargent, Watson, Harkness, and Mr. Burr.

PHYSICS XIV.

This class is required of students in the second year in courses A, B, C, D, M. There are three lectures per week in the first term and two in the second, four laboratory hours in the first term and two in the second.

The work comprises nearly all of the work of Physics III and parts of Physics IV. Approximately two-thirds of the time is given to Mechanics and one-third to Electricity and Magnetism.

Lectures—Monday and *Thursday,* 10-11; *Tuesday* 10-11 (a).

Professors Flammer, Sargent, and Dr. Chipman.

Laboratory—Section 1, *Monday,* 3-5 (a); *Tuesday,* 1-3.

Section 2, *Monday,* 1-3 (a); *Tuesday,* 3-5.

Professors Sargent, Cave, Harkness, and Mr. Hay.

PHYSICS V.

Required of students in third year of Courses G and H.

The work of this class comprises a course of lectures on the Elementary, Mathematical Theory of Electricity and Magnetism, and a course of laboratory experiments in advanced electrical measurement.

In the lectures are treated such topics as the more important laws and theories in Electrostatics, the laws of the Magnetic Field, Electrodynamics and Electromagnetic Induction. At each lecture problems are assigned for solution and these are later discussed in class.

In the laboratory the students make detailed study of several groups of experiments. These comprise careful study of galvanometers using both steady and transient currents, measurements of capacities, permeability, insulation resistance, and self and mutual inductance, the use of the potentiometer in measurement of electro-motive force of cells, calibration of voltmeters and ammeters, and study of electrical waves and discharge phenomena.

Lecture—Thursday, 9-10, first term.

Thursday 4-5, second term.

Laboratory—Wednesday, 2-4.

Professor Flammer.

PHYSICS VI.

Elementary Theoretical Mechanics.

Required of students in third year of Course H.

This course consists of a series of lectures in which the elements of Statics and Dynamics of a Particle are discussed.

Lectures—Tuesday, Thursday and *Saturday,* 10-11, second term.

Laboratory—Monday, 1-3, second term.

Professors Flammer and Watson.

PHYSICS VII.

Required of students in third year of Course H.

HEAT. This part of the course is an introduction to Thermodynamics, beginning with a detailed discussion of the isothermal and the basis of thermometry and continuing with the development of the laws of Thermodynamics and a discussion of entropy, its properties and applications.

ELECTRICITY. The general aim of this part of the course is to acquaint the student with the modern developments in such branches of Physics as Radiation, X-rays, Conduction of Electricity through Gases, Radioactivity, etc.

Text Book—*Ions, Electrons and Ionizing Radiations,* by J. A. Crowther.

Lectures—Monday and Wednesday, 11-12; *and Friday,* 11-12, first term.

Laboratory—Thursday, 1-3.

Dean Clark, Professors Gray and Cave, and Mr. Hay.

PHYSICS IX.

Required of students in fourth year of Course H.

MECHANICS OF RIGID AND ELASTIC BODIES. This part of the course includes a discussion of such topics as the Motion of a Rigid Body, Ellipsoids of Inertia, Motion with Fixed Axis and Fixed Point, Euler's Equations, and applications to motion of the symmetrical top; Stress and Strain relations in Elastic Bodies, Elastic Constants.

ELECTRICITY. The lectures in this part of the course are on advanced Electrodynamics.

Monday, Wednesday and Friday, 11-12.

Professor Flammer.

PHYSICS X.

Required of students in fourth year of Course H.

KINETIC THEORY OF GASES. This part of the course includes the topics of the Maxwellian distribution of velocities, free path phenomena, viscosity, thermal conductivity, diffusion, Van der Waal's equation, and the quantum theory as applied to specific heats and to radiation.

PHYSICAL OPTICS. The lectures in this part of the course are on the theory and phenomena of Physical Optics, including a discussion of Wave Motion, Diffraction, Interference Spectroscopes, Polarization and Double Refraction.

Text Book—*Kinetic Theory of Gases* by Bloch.

Lectures—First term, *Tuesday*, 10-11, *Thursday*, 11-12, and *Friday*, 10-11; second term, *Tuesday* and *Thursday*, 11-12.

Laboratory—Tuesday, 1-4, second term.

Professors Gray and Robertson.

PHYSICS XIII.

Required of fourth year students in Course H.

An advanced laboratory course of experiments in Optics, Electricity and Magnetism and Heat.

Thursday and *Friday,* 1-4. Dean Clark and Professor Robertson.

PHYSICAL LABORATORIES.

The Physics Department is located in Ontario Hall, and contains two large lecture rooms, with seating capacities of 125, and 90 respectively, a small lecture room with seating capacity of 60, two small class rooms, three large rooms equipped as general elementary laboratories, and another room equipped for advanced work, offices for the staff, research rooms, a large, well-lighted library and reading room, smaller rooms for special purposes, apparatus and store rooms. The equipment for lecture table and laboratory is steadily growing and comprises most of the more important pieces of apparatus for these purposes.

Research in Physics is being carried on by members of the staff and by senior students. It is desired to extend this activity as far as possible. A limited number of workers who desire to use the facilities of the laboratory may be admitted and assisted. Particulars may be obtained from the Professor of Physics.

LIBRARY

The Departmental library contains text-books, works of reference, and journals devoted to Physics and related subjects. These may be freely consulted by the student in the reading room between the hours of 8 a.m. and 5 p.m. Books may in general be taken from the building overnight upon reporting to a member of the staff and making a record in a book provided for that purpose. Books may be kept longer than one night at a time only by special permission.

CHEMISTRY.

Professor—J. A. McRae, M.A., Ph.D., F.I.C., F.R.S.C.

Professor of Industrial Chemistry—L. F. Goodwin, F.C.G.I., Ph.D., F.I.C.

Associate Professor—Grenville B. Frost, B.A., Ph.D.

Associate Professor—L. A. Munro, M.A., Ph.D., F.C.I.C.

Associate Professor—J. F. Logan, M.A., Ph. D.

Associate Professor—Roy L. Dorrance, M.A., F.C.I.C.

Lecturer—E. G. Taylor, B.Sc., Sc.M., Ph.D., A.I.C.

Lecturer—R. N. Jones, M.Sc., Ph.D.

Canadian Industries Ltd. Fellow—R. Y. Moir, M.A.

Reuben Wells Leonard Fellow—L. M. Wise, B.A.

Milton Hersey Fellow—W. W. Maynard, B.Sc.

William Neish Fellow—

Demonstrators—A. G. Stewart, B.A., C. Gogek, B.Sc.

	First Courses.	Second or Advanced Courses.	Research Training Courses.
General Chemistry	I	II, III	IV
Qualitative Analysis	I	———	—
Organic Chemistry	I, V	II	IV
Quantitative Analysis	I, II	———	IV
Physical Chemistry	I	II, III	IV
Industrial Chemistry	I, II	IIIa	IV
Colloid Chemistry	Ia	II	IV

General Chemistry I.

For all first year students in Science.

The history, methods of preparation, properties and industrial applications of the more important non-metallic elements and their compounds are discussed in the lectures and the fundamental theories, laws and principles of chemistry emphasized. The first part of the laboratory work consists of a number of experiments illustrating gravimetric and volumetric procedures, in the second part the qualitative reactions of the acid radicals are studied. A set of problems is assigned each week.

Text-books — Sherwood Taylor, *Inorganic and Theoretical Chemistry,* (Heinemann); Partington and Stratton, *Intermediate Chemical Calculations* (Macmillan).

Lectures—Monday, Wednesday, Friday at 9, or *Monday, Wednesday* at 2 and *Friday* at 11, in room 310, Gordon Hall.

Laboratory—Sections 5-8, *Tuesday,* 1-4. Sections 1-4, *Wednesday,* 1-4 in laboratories 305, 308, 301 Gordon Hall.

Professor Dorrance.

General Chemistry II.

For students in Courses EFG Second Year.

This lecture course is designed to supplement Chemistry I, including such chemical principles, facts and theories as find application in Civil, Mechanical and Electrical Engineering. Some of the topics dealt with are the chemistry of the metals, fundamental chemical theory, the laws of solution, and its measurement, the colloidal state, simple organic types and electrochemistry. These topics are illustrated by lecture experiments, problems and technical applications appearing in current Engineering Journals.

Text-books—Chapin, *Second Year College Chemistry* (Wiley and Sons); Sherwood Taylor, *Inorganic and Theoretical Chemistry* (Heinemann).

Reference text—Gyngell, *Applied Chemistry for Engineers.*

Lectures—Thursday 8-9, and *Saturday* 11-12.

Professor Munro.

General Chemistry III.

Advanced Inorganic Chemistry.

For students in Course B, third year.

A study of inorganic chemistry based on the modern form of the periodic system and the electronic theory of valency.

Lectures—Monday and *Wednesday* at 9.

Professor Frost.

General and Inorganic Chemistry IV.

Research Training

For students in Course B, fourth year, electing thesis option in General and Inorganic Chemistry.

Professors Frost, Munro, and Dr. Taylor.

Qualitative Analysis I.

For students in Courses A, B, C, D, M, second year.

The lectures deal with the theory of analytical chemistry. The modern concept of the structure of matter is related to analytical behaviour. The development and application of the laws of equilibrium and solutions are emphasized.

The laboratory work consists of the systematic analysis of basic and acid ions leading to the analysis of alloys, salt mixtures, minerals and various commercial products.

Texts—Engelder, *Semi-Micro Qualitative Analysis,* (Wiley), Munro and Pearce, *Laboratory Chart.*

Reference Texts—Treadwell and Hall. Vol. I. (Wiley); Curtman, *Qualitative Chemical Analysis* (Macmillan); Sherwood Taylor, *Inorganic and Theoretical Chemistry* (Heinemann).

Lectures—Tuesday and *Thursday,* 11-12, Gordon Hall.

Laboratory—Friday, 1-4; *Saturday,* 9-12. Professor Munro.

Organic Chemistry I.

For students in Courses B and D, third year.

An introductory course on the chemistry of the compounds of carbon. The principal classes of aliphatic and aromatic compounds are studied to illustrate both their theoretical and practical importance. In the laboratory a number of aliphatic and aromatic compounds is prepared to illustrate typical operations employed in organic chemistry.

Texts—Conant, *The Chemistry of Organic Compounds* (Macmillan); Adams and Johnson, *Laboratory Experiments in Organic Chemistry,* (Macmillan).

Lectures—Wednesday and Friday, at 11 in room 310 Gordon Hall (Wednesdays) and in Nicol Hall (Fridays).

Laboratory—B students, *Monday,* 1-4 in rooms 213 and 201, Gordon Hall. D students, *Wednesday,* 1-4, first term, and *Saturday,* 9-12, in the second term.

Professors McRae and Logan.

Organic Chemistry V.

For students in Course M, third year.

An introductory course in Organic Chemistry for students in Metallurgy.

Text-book—Garard, *Introduction to Organic Chemistry* (Wiley).

Lecture—Friday, 11-12.

Dr. Jones.

Organic Chemistry II.

For students in Course B, fourth year.

The principal reactions used in synthetic organic chemistry with practical illustrations in the laboratory. The more detailed chemistry of the aliphatic and aromatic series and of the simpler types of heterocylic compounds. Laboratory practice in qualitative and quantitative organic chemistry.

Text-books—Conant, *The Chemistry of Organic Compounds* (Macmillan); Adams and Johnson, *Laboratory Experiments in Organic Chemistry* (Macmillan).

Books of Reference—Karrer, *Organic Chemistry* (Elsevier Co); Francis, *Notes on Organic Chemistry* (Arnold); Hickinbottom, *Reactions of Organic Compounds* (Longmans, Green, and Co.); Kipping and Kipping, *Perkin and Kipping's Organic Chemistry,* Part III; Gattermann-Wieland, *Laboratory Methods of Organic Chemistry* (Macmillan).

Lectures—Tuesday and Thursday, at 11, in room 105, Gordon Hall.

Laboratory—Thursday, 1-4; *Saturday,* 9-12, in room 213, Gordon Hall.

Professor McRae.

Organic Chemistry IV.

Research Training.

For students in Course B, fourth year, electing thesis option in Organic Chemistry. Professor McRae and Dr. Jones.

Quantitative Analysis I.

For students in Courses A, C, D and M, third year.

This is an elementary course designed to illustrate the fundamental procedures of Quantitative Analysis.

Text—Talbot, *Quantitative Chemical Analysis.*

Lectures—A and C, *Thursday* 1-2, D and M, *Wednesday* 10-11, in room 400, Gordon Hall.

Laboratory—Thursday, 1-4 for D, *Friday,* 1-4 for C and M, *Tuesday,* 1-4, Section 1 of A. *Saturday* 8-11, Section 2 of A.

Professor Dorrance.

Quantitative Analysis II.

For students in Course B, third year.

The theory and technique of gravimetric and volumetric analysis.

Texts—Talbot, *Quantitative Analysis;* Vogel, *A Text Book of Quantitative Inorganic Analysis* (Longmans).

Lectures—Tuesday and *Thursday* at 8, in room 400, Gordon Hall.

Laboratory—Wednesday, 1-4 and *Thursday,* 1-4; *Saturday,* 8-12, second term, in 207, 210 Gordon Hall.

Professor Dorrance.

Quantitative Analysis IV.

Research Training.

For students in Course B, fourth year, electing thesis option in Quantitative Analysis. Professor Dorrance.

Physical Chemistry I.

For students in Courses B, C, D, M, third year.

The pressure-volume relations of gases; the nature of the liquid and solid states; solutions; chemical and phase equilibria; thermochemistry; chemical kinetics, and other related topics.

Text—Millard, *Physical Chemistry for Colleges* (McGraw-Hill).

Lectures—Tuesday and Thursday, at 9, in room 105, Gordon Hall.

Laboratory—Friday, 1-4 for B, *Tuesday,* 1-4 for C, *Wednesday* 1-4 (a) and *Saturday* 9-12 (b) for M, in 115, 116 Gordon Hall.

Students in course D will take physical chemical laboratory in the Chemical Engineering Department, under Dr. L. F. Goodwin.

Tuesday, 1-4, D. Professor Frost.

Physical Chemistry II.

Electrochemistry.

For students in Courses B, D, M, fourth year.

A discussion of the electrochemistry of aqueous solutions; applications to chemical analysis and to industrial processes, including fused systems.

The laboratory work includes electrolytic preparations, electrical measurements of the properties of solutions and electrometric titrations.

Text—Thompson, *Theoretical and Applied Electrochemistry.* (Macmillan).

Reference Texts — Glasstone, *The Electrochemistry of Solutions* (Methuen); Creighton and Koehler, *Electrochemistry,* Vols. I and II (Wiley); Kolthoff and Laitenen, *pH and Electrotitrations* (McGraw-Hill); Mantell, *Industrial Electrochemistry* (McGraw-Hill).

Lectures—Monday at 10 and *Tuesday* at 8.

Laboratory—B and M, *Wednesday* 1-4; D, *Thursday* 2-5.

Dr. Taylor.

Physical Chemistry III.

Advanced Physical Chemistry.

For students in Course B, fourth year.

The principles of chemical thermodynamics and their application to chemical problems.

Lectures—Tuesday and Thursday, at 10, in 105 Gordon Hall.

Laboratory—Friday, 1-4, in 116 Gordon Hall.

Professor Frost.

Physical Chemistry IV.

Research Training.

For students in Course B, fourth year, electing thesis option in Physical Chemistry. Professors Frost, Dorrance, Munro, and Dr. Taylor.

Industrial Chemistry I.

For students in Course E, fourth year.

For outline of topics see under Department of Chemical Engineering.

Industrial Chemistry II.

For students in courses B and D, third year.

D students, third year, see under Department of Chemical Engineering.

The lectures deal with the following topics: wood, coal and other fuels: for steam raising and drinking purposes; the petroleum industry; industrial gases, gas producers, by-product coke and illuminating gas; sulphuric acid, alkali and ammonia; hydrochloric, nitric and acetic acids, acetone; electric furnace products, fertilizers, explosives and artificial silk, manufacture of wood pulp.

In the laboratory typical processes, such as dissolution, crystallization, water and gas analysis, ordinary and fractional distillation, preparations involving incomplete chemical reaction, are studied, emphasis being laid on systematic records and interpretation of results.

Text—E. R. Riegel, *Industrial Chemistry.*

Handbooks—Hodgman-Lange, *Handbook of Chemistry and Physics* (Chemical Rubber Co.), or Lange's *Handbook of Chemistry* (Handbook Publishing Co.).

Lectures—Tuesday and Thursday at 10-11, Ontario Hall.

Laboratory—B, *Tuesday* 1-4, in Ontario Hall.

D students see under Dept. of Chemical Engineering.

Professor Goodwin.

Industrial Chemistry IIIa.

For students in Course B, fourth year—first term.

For outline of topics see under Department of Chemical Engineering.

Texts—E. R. Riegel, *Industrial Chemistry;* Badger and Baker, *Inorganic Chemical Technology.*

Lectures—Wednesday and *Friday,* at 11, first term, in Ontario Hall.

Laboratory—Monday, 1-4, first term, in Ontario Hall.

Professor Goodwin.

Industrial Chemistry IV.

Research Training.

For students in Course B, fourth year, electing thesis option in Industrial Chemistry.

Professor Goodwin.

Colloid Chemistry Ia

For students in Course D, fourth year, first term. A short introductory course in Colloid Chemistry. The lectures deal with the general properties of the colloidal state, particle size and sedimentation analysis, dialysis, ultrafiltration and electrokinetic phenomena.

The laboratory work illustrates and supplements the material dealt with in lectures.

Text-book—Hedges, *Colloids* (Arnold).

Reference Text—Lewis, Squires & Broughton, *Colloidal and Amorphous Materials* (Macmillan).

Lectures—Wednesday at 10, first term.

Laboratory—Tuesday 1-3, first term.

Professor Munro

Colloid Chemistry II

For students in Course B, fourth year.

A course in Surface Chemistry treating the general properties of the colloidal state and heterogeneous catalysis. The lectures deal with the following topics: the colloidal state, particle size and sedimentation, dialysis, Donnan equilibrium, ultrafiltration, electrokinetic phenomena, surface energy, interfacial tensions, flocculation and protective action, emulsions, foams, gels, plastics, sorption, the mechanism of catalysis, activation, promotors, carriers, retarders, mixed catalysts and heterogeneous chain reactions.

The laboratory work illustrates the topics dealt with in lectures.

Texts—Hartman, *Colloid Chemistry* (Houghton Mifflin Co.); Griffith, *The Mechanism of Contact Catalysis* (Oxford University Press).

Reference Texts—Weiser, *Inorganic Colloid Chemistry,* I-III (Wiley); McBain, *The Sorption of Gases by Solids* (Routledge); Maxted, *Catalysis and its Industrial Applications* (Churchill); Berkman, Morell and Egloff, *Catalysis* (Reinhold Corp.).

Lectures—First term, *Wednesday* and *Friday* at 10 a.m.
Second term, *Wednesday* and *Friday* at 11 a.m.

Laboratory—Tuesday 1-3 p.m., first term only. Professor Munro

GEOLOGY

Professor—M. B. Baker, B.A., B.Sc., F.G.S.A., F.R.S.C.

Miller Memorial Research Professor—
E. L. Bruce, B.Sc., M.A., Ph.D., F.R.S.C., F.G.S.A.

Professor—B. Rose, B.Sc., Ph.D., F.G.S.A., F.R.S.C.

Lecturer—M. L. Keith, B.Sc., M.Sc., Ph.D.

Assistant—R. J. MacNeill.

Research Assistant—D. F. Hewitt.

The Geological and Mineralogical Museum, situated on the ground floor of Miller Hall, is equipped with splendid collections of minerals, ores, rocks and fossils, classified and systematically arranged to illustrate most of the subjects treated in lectures. This is a section of the work in which the co-operation of the mining public is invited, and all donations to this museum will be kept and credited to the donor.

The various courses in Geology, described in some detail below, are intended to equip the professional geologist, the mining engineer, the civil engineer requiring a knowledge of the relative merits of natural construction material.

GEOLOGY I.

For second year students in courses A, B, C, D, M.

Elementary Geology. Students taking this class must have passed in Chemistry I.

An introductory course in general Geology is given preparatory for those students who proceed to a more advanced course in Geology or Mining, and at the same time a more or less complete, though elementary course for those who do not pursue the subject any farther.

During the month of October excursions will be conducted to places of geological interest in the vicinity of Kingston. Students in Geology and Mineralogy are required to take part in these excursions.

Text-book: Miller, *Elements of Geology,* (Van Nostrand Co.).

Lectures—Tuesday and Thursday, 9-10. Professor Baker.

GEOLOGY II.

For third year students in course C.

STRUCTURAL, DYNAMICAL, AND PHYSIOGRAPHICAL GEOLOGY. Before taking this class students must have passed in Geology I.

The principles of gradation, deformation, faulting, mountain formation, and vulcanism are covered in a more general and a more advanced way than in Geology I. Attention is also given to the origin of the earth; the metamorphic cycle; types of marine and continental sedimentation; an introduction to paleontology, physiography, map reading and interpretation.

Text-books—Nevin, *Structural Geology;* Platt, *Geological Map Exercises.*

Lectures—Wednesday and *Friday,* 9-10. Professor Rose.

Laboratory—Tuesday, 3-5.

GEOLOGY III. (b)

For students in Courses A and C, third year.

ELEMENTARY PETROGRAPHY. Students must have passed in Geology I.

This course is essentially on igneous geology and petrography, and on the determination of some of the more common rocks and rock minerals by both field and microscopic tests. Some attention will be paid to the sedimentary and metamorphic rocks. The lectures will be supplemented by laboratory work on hand specimens and rock slices.

Text-book—Pirsson and Knopf, *Rocks and Rock Minerals.*

Lectures—Tuesday and Thursday, 10-11, second term.

Laboratory—Wednesday, 1-3, and 3-5. Dr. Keith.

GEOLOGY IV.

For third year students in Course A.

STRUCTURAL GEOLOGY—Students must have passed in Geology I.

Imposed structures in sedimentary, igneous, and metamorphic rocks, with particular attention to faulting, folding, and shearing. Illustrated mainly from Canadian occurrences where possible.

Text-book—Nevin, *Structural Geology.*

Lecture—Tuesday and *Friday,* 11-12 (a). Professor Rose.

GEOLOGY V.

For fourth year students in Courses A and C.

GEOLOGY OF CANADA. Before taking this class, students must have passed in Geology I and IIIb.

In this course special attention will be given to Pre-Cambrian Geology, and the distribution of the various rock formations in Canada. The topography as well as the structural make-up of the Dominion is studied.

Lecture—Wednesday, 9-10. Professor Bruce.

GEOLOGY VI.

For fourth year students in Course C.

HISTORICAL GEOLOGY. After a brief study of the various types of sedimentary formations and the principles of paleogeography, the history of the North American continent is taken up with supplementary references to the other continents when desirable. Emphasis is laid on Canadian occurrences. A number of the more important fossils of each period are studied, and their recognition on sight required. Brief consideration is also given to the history of the Science of Geology.

Text-book—Schuchert and Dunbar, *Text-book of Geology, Part II.* (Historical, John Wiley and Sons).

Lectures—Tuesday and Thursday, 9-10. Professor Rose.

Laboratory—Monday, 2-4.

GEOLOGY VII.

For third year students in Course C and fourth year students in Course A (geology option).

MICROSCOPICAL PETROGRAPHY. A laboratory class on the identification of rocks and rock minerals under the microscope. A more intensive study is made of the features of igneous, sedimentary and metamorphic rocks than was possible in Geology III(b).

Laboratory—Thursday, 2-4, second term.

Dr. Keith.

GEOLOGY VIII.

For fourth year students in Courses A and C.

ECONOMIC GEOLOGY. This class treats of the principles of ore deposition. The basis of classification and the fundamental principles underlying the formation of economic deposits.

Text-book—Tarr, *Introductory Economic Geology* (McGraw-Hill).

Lectures—Monday and *Tuesday,* 11-12.

Professor Baker.

GEOLOGY IX.

For third year students in Course E.

ENGINEERING GEOLOGY. This course is intended for students in Civil Engineering, and after a brief introduction to geology will treat of the occurrence, composition, texture, structure and alterations of rocks, with

special reference to their effects on the workability or removal of the rocks in excavation, and in the selection of raw material in construction work. There will also be lectures on clay-products and the selection of building materials, and an outline of the manufacture of bricks, fire-proof blocks, terra-cotta, roofing-tile, sewer-pipe, and drainage-tile, will be given. Physiography and drainage will also be studied, and a brief discussion of the principles of economic geology.

Text-book—Ries and Watson, *Elements of Engineering Geology.*

Lectures—Wednesday and Thursday, 11-12. Professor Baker.

GEOLOGY X.

For third year students in Course C and fourth year students in Course A (geology option).

Field Geology. The field and laboratory work of this class consists of a systematic survey of an area in the vicinity of Kingston. Students are given practice in the methods of geological survey, the plotting of outcrops, the measurement of stratigraphic sections, the determination of levels, and then the preparation of a contoured geological map to scale, together with a geological report on the area studied.

Instruction is given on instrumental methods of geological survey, and on the techniques of geophysical prospecting. Emphasis is placed on the application of various geophysical methods to particular problems in geology, and on control of such surveys, and the interpretation of results by the geologist.

Reference Books—Lahee, *Field Geology;* Eve and Keys, *Applied Geophysics in the Search for Minerals;* Heiland, *Geophysical Exploration.*

Monday, 1-5. Dr. Keith.

GEOLOGY XII.

For fourth year students in course C.

Advanced Petrology.

A course of lectures will be given on the recognition and classification of igneous, sedimentary and metamorphic rocks. Considerable attention will be given to the genesis of rock types and to the physico-chemical conditions effective in the generation and the differentiation of magmas.

Text-book—Grout, *Petrography and Petrology.* (McGraw-Hill).

Lectures—Wednesday and *Friday,* 11-12, first term.

Laboratory—Wednesday, 2-4 first term. Dr. Keith.

Reports

For fourth year students in Course C.

Weekly reports or essays based on field trips, summer work, or on topics of a mineralogical or geological nature as prescribed by the departments of Geology and Mineralogy will be required. These are intended to test the students' ability to read up a subject, and then to summarize it in presentable form for publication. The class will be conducted by the department of Geology for the first term, and by the department of Mineralogy for the second term. Professor Baker.

GRADUATE COURSES

For graduates in Courses A (Geology option) and C.

GEOLOGY XIII.

PRINCIPLES OF PRE-CAMBRIAN GEOLOGY. The origin, history and distribution of the rocks older than the Cambrian. Special attention will be given to Canadian Pre-Cambrian areas. It will not be offered in 1943-44.

Lectures—Monday and *Wednesday* at 11.

Laboratory—Friday, 1-4.

Professor Bruce.

GEOLOGY XIV.

METAMORPHIC AND STRUCTURAL GEOLOGY. The processes of rock weathering, consolidation of sediments, formation of gneisses, and the wall rock alterations produced by veins are studied in detail. The principles of rock deformation are discussed. The course will be offered in alternate years. It will not be offered in 1943-44.

Lectures—Tuesday and Friday at 11.

Laboratory—Friday 1-4 or *Saturday* 9-12.

Professor Bruce.

GEOLOGY XV.

PRE-CAMBRIAN ORE DEPOSITS. Discussion of ore deposits in Pre-Cambrian rocks with especial reference to those in Canada. The genesis and character of the deposits will be studied in detail. It will be offered in 1943-44.

Text Book: Bruce, *Mineral Deposits of the Canadian Shield,* (Macmillan).

Lectures—Tuesday and Friday at 11.

Laboratory—Tuesday, 1-4 or *Wednesday,* 1.4.

Professor Bruce.

Excursions to accessible localities are required.

GEOLOGY XVI(a)

CHEMICAL PETROLOGY. This course comprises a critical review of petrological processes. It is planned as a directed discussion based upon selected references pertaining to both laboratory and field investigations of the genesis of rocks.

Lectures—Monday at 9, first term.

Reading—Time to be arranged. Dr. Keith.

GEOLOGY XIX.

REGIONAL GEOLOGY. A study of the general geology of selected regions to illustrate geological processes and to correlate the stratigraphic and diastropic history of the world.

Periods to be arranged. Professor Rose.

SEMINAR

A Seminar for students in graduate courses meets two evenings each month. It is voluntary and no registration is required.

MINERALOGY

PROFESSOR—J. E. Hawley, M.A., Ph.D., F.G.S.A., F.R.S.C.

LECTURER—N. W. Buerger, S.M., Ph.D., F.M.S.A. (on leave of absence).*

ASSISTANTS—J. M. Harrison, B.Sc., M.A.. M. Young.

The work in this department is intended for students taking the courses in (1) Mining Engineering, (2) Chemistry, (3) Mineralogy and Geology, (4) Chemical Engineering, and (5) Metallurgical Engineering.

MINERALOGY I.

For Second year students in Courses A, B, C, D, M.

ELEMENTARY MINERALOGY—Lectures cover (1) the physical properties and identification of the common rock and ore forming minerals, (2) The relation between Mineralogy and Geology, (3) The chemistry of minerals, (4) Crystallography, (5) World distribution of minerals which are of economic importance, (6) the detailed properties, occurrence and uses of about one hundred important minerals. In the laboratory practical work is given in crystallography and in the identification of minerals by physical tests and blowpipe methods.

Field trips during October and November are held in conjunction with the Department of Geology.

Each student is supplied for the session with a locked cabinet containing a collection of minerals for which he is held responsible. *A practical examination requiring the identification of minerals in hand specimens must be passed by each student before credit in this course will be given.* Students are urged to make use of the museum, and of the study room provided for them in the Mineralogy department.

Text-books—For Courses A and C, Ford, *Dana's Text-book of Mineralogy,* (Wiley, 1932), 4th edition. For Courses B and D, choice of Hurlbut, *Dana's Manual of Mineralogy,* 15th edition, 1941; or Kraus, Hunt, and Ramsdell, *Mineralogy* (McGraw-Hill, 1936).

Books of reference—Kraus and Hunt, *Mineralogy,* 3rd edition (McGraw-Hill, 1936); Rogers, *Study of Minerals,* 3rd edition (McGraw-Hill, 1937); Brush and Penfield, *Manual of Determinative Mineralogy and Blowpipe Analysis,* 17th edition, 1912 (Wiley).

Saturday Excursions.

Lectures—Friday at 8, first term; *Tuesday* at 10 and *Friday* at 8, second term.

Professor Hawley.

Laboratory—Monday, 1-3, Section 1, *Monday,* 3-5, Section 2, first term; *Tuesday,* 1-3, Section 2, *Tuesday,* 3-5, Section 1, second term.

* Lieutenant, United States Naval Reserve.

MINERALOGY II.

PHYSICAL MINERALOGY. For students in Course C, Third year, and Course A, Fourth year, Geology option.

The work consists of a course of lectures, dealing with crystallography, crystal measurements and drawing, and a more advanced study of the physical properties of minerals.

Text-books—Dana, *Text-book of Mineralogy,* 1932. (Wiley & Sons).
James, *X-Ray Crystallography* (Methuen), 1930.

Books of Reference—Bragg, *Atomic Structure of Minerals* (Cornell Univ. Press), 1937; Wyckoff, *The Structure of Crystals,* (1931); Bragg, *X-Ray and Crystal Structure,* 4th Edition.

Lectures—Monday at 10 and *Friday* at 11. second term.

Laboratory—Saturday, 10-12, second term.

Professor Hawley.

MINERALOGY III.

For students in Courses B, and C, third year, and Course A, Fourth year, Geology option, first term.

OPTICAL MINERALOGY—The work of this class deals with the optical properties of nonopaque chemical substances and natural minerals. For chemistry students it serves as an accurate method of identifying both organic and inorganic solid chemical substances by their indices of refraction and other optical properties, provided these are known, as a method of proving homogeneity of fine chemical compounds, and as an introduction to microchemical methods of testing for minor constituents in inorganic compounds. For geology and mineralogy students it is preparatory to the classes of petrography and determinative mineralogy and deals with the optical properties of the common rock forming minerals.

Text-book—Dana, *Text-book of Mineralogy,* 4th ed., 1932 (Wiley), or Winchell, *Elements of Optical Mineralogy* (Part I), 5th ed., (Wiley), 1937, or Rogers and Kerr, *Optical Mineralogy* (McGraw-Hill), 1942.

Reference texts—Groth and Jackson, *Optic Properties of Crystals* (Wiley), 1910; Hartshorne and Stuart, *Crystals and the Polarising Microscope* (Arnold), 1934.

Lectures—Monday and Friday, at 10, first term.

Laboratory—A—Geology Option and C—Tuesday 1-3, *B—Saturday,* 10-12, first term.

Dr. M. L. Keith.

MINERALOGY IV.

For students in Courses A and C, Third year.

DESCRIPTIVE AND DETERMINATIVE MINERALOGY—ORE MINERALS. A course dealing with minerals which are important as ores of iron, manganese, chromium, tungsten, vanadium, tin, nickel, cobalt, gold, silver, copper, lead, zinc and aluminum. In the laboratory suites of ore minerals from various mining camps are examined by blowpipe methods and microscopically by polished sections. A brief survey is made of some important non-metallic minerals. Cabinets furnished with specimens of minerals from various parts of the world are supplied for students' use. Examination of a variety of mineral deposits in the vicinity of Kingston is made in October and November. Reports on these are required.

Text-books—Dana, *Text-book of Mineralogy,* 4th ed. 1932 (Wiley); choice of Tarr, *Introductory Economic Geology* (McGraw-Hill 1938), or Lindgren, *Mineral Deposits* (McGraw-Hill 1933). Reports on various deposits will be available in reading room.

Lectures—Tuesday and *Thursday,* 8-9 (a); *Wednesday* and *Friday,* at 10 (b).

Laboratory—Wednesday, 1-3, and 3-5 if two sections are necessary.

Professor Hawley.

MINERALOGY V.

For students in Course C, Fourth year.

ADVANCED DESCRIPTIVE AND DETERMINATIVE MINERALOGY—NON-METALLIC MINERALS. A course dealing (1) with the identification of rock forming minerals by physical and optical properties; (2) the occurrence and utilization of non-metallic minerals used for Abrasives, Refractories, Ceramic Ware, Lime, Cements, Plaster, Fertilizers, Pigments, Insulators, Building Stone, Gems, etc.

Text-book—*Elements of Optical Mineralogy*—Part II, (Description of Minerals), A. N. Winchell, (Wiley and Sons).

Reference Books—*Publications of Geological Survey of Canada; Publications of Mines Branch, Dept. of Mines, Canada; Publications of U.S. Geol. Survey; Non-Metallic Minerals*—Ladoo (McGraw-Hill, 1925).

Lectures—Tuesday and *Thursday* at 10 (a); *Wednesday* at 11, *Thursday* at 10 (b).

Laboratory—Friday, 1-3. Professor Hawley.

MINERALOGY VI.

For fourth year students in Courses C, A (Geology Option), and M (optional).

MINERALOGRAPHY—An advanced laboratory course in the study of metallic minerals in polished sections.

Text—Microscopic Determination of the Ore Minerals, U.S.G.S. Bull. 914, 1940. M. N. Short.

Laboratory—First term, *Thursday,* 2-4.

Lecture and Discussion—Thursday, 1-2, first term only.

Professor Hawley.

MINERALOGY VIIa

For third year students in Course M.

ORE MINERALS—Their properties, chemistry and association. A course of lectures for third year Metallurgy students consisting of the first term lectures of Mineralogy IV.

Lectures—Tuesday and *Thursday* at 8, first term.

Research and Thesis—Students wishing to undertake the research work and thesis of the fourth year under the Department of Mineralogy should consult with the instructors not later than the beginning of their fourth year with regard to research subjects and hours.

GRADUATE COURSES

For graduates in Courses A and C.

MINERALOGY XV.

ADVANCED OPTICAL MINERALOGY—A course designed to give students further training in the determination of optical properties of minerals. Special study will be made of igneous and metamorphic minerals, and of the heavy residuals of sedimentary rocks. Offered during session 1943-44.

Lectures and Laboratory—6 hours a week, to be arranged.

Professor Hawley.

MINERALOGY XVI.

(a) ADVANCED STUDY OF ORE MINERALS AND MINERALOGRAPHY:

Texts—Lindgren's *Mineral Deposits* (McGraw-Hill 1933).
Determination of the Ore Minerals, U.S.G.S. Bull. 914, 1940. N. M. Short.

This course alternates with Mineralogy XV. Not offered in session 1943-44.

Lectures and Laboratory—Four hours a week to be arranged.

Professor Hawley.

MINERALOGY XVIIa

STRUCTURAL CRYSTALLOGRAPHY—An introduction to our present knowledge of the structure of crystals, mainly by means of x-ray diffraction data, and the application of this knowledge to mineralogy. The lectures include: simple aspects of x-ray diffraction theory useful in crystallographic investigation, the powder method, the rotating and oscillating crystal method, and the Weissenberg method; the fundamental laws of crystal chemistry, radius ratio, co-ordination number, polarizability, ionic structures, electron pair bond structures, metallic structures; the silicates and silicate framework crystals; isomorphism, polymorphism, disordered structures, superstructures, solid solution; the determination of phase diagrams and inversion by means of controlled temperature x-ray powder photographs. Laboratory work consists of familiarizing the student with x-ray equipment such as transformers, tubes, protective devices, and the various types of diffraction cameras; practical work with mineral "fingerprinting", or comparisons, by means of powder diffraction patterns, interpretation of simple patterns obtained by powder and rotating crystal methods; practical work with controlled temperature powder camera.

Text-book—R. W. James, *X-Ray Crystallography* (Methuen, 1930).

Reference books—W. H. Bragg and W. L. Bragg, *The Crystalline State* (Macmillan, 1934); R. C. Evans, *An Introduction to Crystal Chemistry* (University Press, 1939). Miscellaneous assigned readings.

Lectures—Two hours per week, to be arranged. Not offered for the duration of the war.

Laboratory—Three hours per week, to be arranged.

Prerequisites—Mineralogy I, and Mineralogy II (10b), or the equivalent. Graduate students in Physics or Chemistry will be admitted to this course.

Dr. Buerger.

MINING ENGINEERING.

Professor—S. N. Graham, B.Sc.

Mining I.

For students in Course A, third year.

The first part of this course includes a discussion of the shape and attitude of ore bodies and the description of the methods of surveying the underground openings required to work them. This is accompanied by drafting room work on mine mapping.

Lectures for the balance of the year include the following: prospecting, mining laws, exploration of prospects, diamond and churn drills, rock drills and steel, explosives, systematic methods of development and a brief description of common mining methods.

One hour a week in the second term is given to the reading and discussion of essays.

Text-books—Peele, *Mining Engineers Handbook;* Lewis, *Elements of Mining.*

Lecture and Laboratory—Tuesday and *Wednesday,* 9-11 (a); *Tuesday, Wednesday,* and *Thursday,* 9-10 (b).

Professor Graham.

Mining II.

For students in Course A, fourth year.

This course is a continuation of Mining I and includes the following subjects: rock pressure and methods of support; systematic study of underground metal mining methods; transportation, mucking, and tramming; drainage and pumping; mine atmospheres and mine ventilation; sampling and estimation of ore; mining costs, mine valuation and reports; a brief discussion of the principles of geophysical prospecting with special attention to magnetic methods.

Text-books—Peele, *Mining Engineers Handbook;* Lewis, *Elements of* Mining.

Lectures—Monday and *Tuesday,* 8-9; *Wednesday,* 10-11.

Laboratory—Monday, 10-11; *Tuesday,* 1-2 (a), 2-3 (b).

Professor Graham.

Mining III.

For students in Course A, fourth year.

This is a drafting room class with problems in the design of mine buildings, wooden headframes and ore bins, arrangement of surface plant and underground workings, and transportation systems.

Text-book—Staley, *Mine Plant Design.*

Wednesday, 1-4.

Professor Graham.

Mining IV.

For students in Courses C and M, fourth year.

This is a course of lectures briefly discussing the formation of ore-bodies, their development and exploitation, the machinery and equipment required, and the sampling and valuation of mining properties. It is intended to link up the work of the geologist and metallurgist with the mine.

Text-books—Lewis, *Elements of Mining;* Hoover, *Principles of Mining.*

Lectures—Monday 1-2.

Professor Graham.

Summer Essay.

For students in Course A, fourth year.

In order to encourage close observation, and the faculty of expressing by text and illustration, the student during his summer vacations is expected to gather material for an essay of from two to three thousand words.

The essay must cover the result of personal observation and be on some subject relating to mining, milling, metallurgy or geology.

The subject title must be given before the end of October, and the essay handed in before the 15th of January. Essays requiring revision must be returned before the spring examinations begin.

All essays must be typewritten and suitably bound.

Ore Dressing.

For students in Courses A, C and M, third year.

These lectures follow the sequence of operations on an ore from the time it reaches the mill until it leaves as a concentrate or bullion. The principles and practice of rock crushing, ball milling, classification and concentration on jigs and tables are fully discussed. Particular attention is paid to the concentration of ores by flotation. Other accessory processes such as magnetic concentration are taken up and the flow sheets of different mills are studied.

Books of reference—Gaudin, *Principles of Mineral Dressing;* Rabone, *Flotation Plant Practice;* Taggart, *Handbook of Ore Dressing;* Richards and Locke, *Text Book of Ore Dressing.*

Lectures—Friday, 8-9, first term, and *Thursday,* 11-12.

Professor Graham.

Milling.

For students in Courses A and M, fourth year.

Ores of the more common metals are investigated in the laboratories to determine suitable methods of concentration of or recovery of their metals by milling. Groups of two or three students are given an ore to investigate. Examination of the ore is first carried through by use of the microscope, by screen analyses, etc. Based on the information thus gained, a course of treatment on a sample of the ore is carried through. Each student takes part in the investigation and treatment of as many ores of the precious metals, and also of those of base metals as time will permit.

Laboratory—Friday, 9-4, and *Saturday,* 9-12.

Professor Lord.

Ore Dressing Laboratories

These are equipped for the testing of ores in small lots from various mining districts.

The equipment consists of a 7 x 10 Blake crusher, rolls and fine grinders. There is a complete equipment of modern small, or miniature machines for testing ores and illustrating principles and processes of treatment. These consist of small ball and pebble mills, various types of screens and classifiers, jigs, Wilfley tables, several types of small flotation machines and magnetic concentrators.

The Metallurgical Laboratories.

The Metallurgical laboratories proper contain a blast furnace and a large roasting furnace, each served by a bag house; a Monarch oil furnace and a gas furnace for obtaining temperatures up to 1400°C; a Hoskins electric furnace for temperatures up to 1700°C; two electric arc furnaces; a vacuum electric furnace; two tubular electric furnaces; a Hump furnace; an electric muffle furnace; two recording potentiometers; thermocouple and optical pyrometers, calorimeters, and a high frequency induction furnace.

The Fire Assaying laboratory contains seven gas muffle furnaces of different sizes, a three-muffle crude oil furnace, and four gasoline crucible furnaces.

The Metallography laboratory is equipped with a complete cutting and grinding plant; a disc polishing machine; microscopes, with complete optical equipment; a vertical micrograph outfit, and the necessary dark room and equipment; and well selected sets of specimens.

Two well appointed chemical laboratories, a balance room and a room for electrolytic assaying complete the laboratory equipment of the Department.

METALLURGY.

PROFESSOR—T. V. Lord, B.Sc.

ASSISTANT PROFESSOR—O. A. Carson, B.Sc., A.M., Ph.D.

METALLURGY I.

For students in Courses E, F, G, third year.

A brief discussion of the physical properties and uses of the common metals. The more important industrial alloys, their composition, properties and uses. Refractory materials. The properties of iron and steel, the effects of impurities and of methods of manufacture and working, and the heat treatment of steel.

Reference Books—Bray, *Ferrous Production Metallurgy*; Rosenholtz and Oesterle, *Elements of Ferrous Metallurgy; Metals Handbook.*

Lecture—Tuesday, 10-11 (a), *Tuesday,* 8-9 (b).

Professor Carson.

METALLURGY II.

For students in Courses A, B, M, third year.

Heat, calorimetry and pyrometry. Solid, liquid, and gaseous fuels and the special metallurgical uses of each kind. An introduction to general metallurgy—principles, operations and appliances. The metallurgy of iron and steel.

Reference Books—Bray, *Ferrous Production Metallurgy*; Rosenholtz and Oesterle, *Elements of Ferrous Metallurgy; Metals Handbook.*

Lectures—Monday, 11-12; *Wednesday,* 8-9 (a); *Tuesday,* 11-12 (b).

Professor Carson.

METALLURGY III.

For students in Course M, third year.

Metallurgy calculations based on the work covered in Metallurgy II.—heat, calorimetry, and pyrometry; heat balance, iron blast furnace charges, etc.

Laboratory—Monday, 9-10; *Wednesday* 9-10, first term; *Monday* 10-11; *Wednesday,* 9-10, second term.

Professor Carson.

METALLURGY IV.

For students in Courses A, M, fourth year.

The metallurgy of the more common non-ferrous metals—gold, silver, copper, lead, and zinc. The extraction of these metals from their ores, the refining of the metals, their uses, and the alloys into which they enter.

A consideration of the ordinary methods of recovering nickel, cobalt, tin, arsenic, antimony, etc., from the ores.

Text Books—Dorr, *Cyanidation and Concentration of Gold and Silver Ores;* Bray, *Nonferrous Production Metallurgy;* Newton and Wilson, *Metallurgy of Copper.*

Lectures—Tuesday, 9-10; *Wednesday,* 11-12; *Thursday,* 11-12.

Professor Lord.

Metallurgy V.

For students in Course M, fourth year.

Metallurgical calculations related to the work covered in Metallurgy IV. Discussions of metallurgical subjects by the students and the reading and discussion of students' essays.

Laboratory—Tuesday, 11-12, first term; *Thursday,* 9-10, second term.

Professor Lord.

Metallurgy VI.

For students in Courses M, G, fourth year.

Electro-metallurgy; introductory course in electro-chemistry followed by the consideration of the electrolytic refining of copper, gold and silver, the electrical smelting of aluminum, and electric furnaces.

Lecture—Wednesday, 8-9, second term. Professor Carson.

Metallurgy VII.

For students in Course M, fourth year.

Metallurgical plant design. The calculation of the capacities of units in a plant—agitators, sumps, pipes, launders, pumps, furnaces, converters, etc. Details of equipment. Flow sheets. General layout of plants. Bills of material. Power requirements.

The work will consist largely of individual problems for the library and drafting room.

Laboratory—Monday, 2-4.

Professor Lord.

Metallurgy VIII.

For students in Course F, fourth year.

Laboratory course dealing with the heat treatment of steel.

Laboratory—Friday, 8-10, first term.

Professor Carson.

Metallography.

Metallography I (*a*), Metallography II (*b*).

For students in Course M, fourth year.

Introductory course in metallography, including:

(*a*) Explanation and interpretation of equilibrium diagrams.

(*b*) Constitution and structure of some industrial alloys, with special reference to brasses, bronzes, bearing metals and different grades of steel.

Lecture and Laboratory work—Monday, 8-9; *Tuesday,* 1-4.

Professor Carson.

Students in Course M, fourth year, who are going into Chemical Metallurgy have the option of substituting Mineralogy VI for Metallography II.

Lecture and Laboratory—Mineralogy VIa, *Thursday,* 1-4 (a).

Professor Hawley.

Metallurgical Laboratory.

For students in Course M, fourth year.

Laboratory course dealing with a number of metallurgical operations. The following experiments are made by the students attending this course: Determination of calorific power and impurities in coals, standardization of pyrometers by various methods, determinations of cooling curves, decomposition of sulphates and reduction of oxides, heat treatment of steel.

Electroplating, operation of electric furnaces.

Laboratory—Thursday, 1-4, first term; *Thursday,* 2-5, second term.

Professor Carson

Summer Essay.

Required of students in Course M, fourth year.

In order to encourage close observation, and the faculty of expressing by text and illustration, the student during his summer vacations is expected to gather material for an essay of from two to three thousand words.

The subject title must be given in by October 15th of the final year, and the essay handed in before the end of the first term of the final year. Essays requiring revision must be returned before the spring examinations begin.

The material on which the essay is based must be information gained at first hand in metallurgical or chemical plants or laboratories or in mills during the equivalent of, at least, one complete summer vacation.

Fire Assaying.

For students in Courses A, M, third year, and Course C, fourth year.

The Laboratory course in fire assaying consists of:

(*a*) A number of experiments to test the action of the different reagents used and slags made in assaying.

(*b*) The determination of lead by fire assay methods.

(*c*) The determination of gold and silver in silicious, oxidized and sulphide ores and mattes.

Text-book—Bugbee, *Fire Assaying.*

Laboratory—First term. Course A, Course C, and M, Section 1, *Tuesday,* 1-5; Second term. Course M, Section 2, *Tuesday,* 1-5.

Professor Lord.

CHEMICAL ENGINEERING.

PROFESSOR—L. F. Goodwin, F.C.G.I., Ph.D., F.I.C.

ASSISTANT PROFESSOR—G. A. Revell, B.Sc., S.M., F.C.I.C.

FELLOW—G. A. Clark, B.Sc.

All lectures and laboratory work in Ontario Hall.

INDUSTRIAL CHEMISTRY I. ENGINEERING CHEMISTRY.

For students in Course E, fourth year.

A lecture course developed for students in Mining, Mechanical and Civil Engineering. Topics such as the rusting of iron and its preservation from corrosion, water for steam raising and domestic use, paints, lubricants, explosives, pyroxylins and cements are discussed, mainly from the engineer's point of view.

Text-books—Leighou, *Chemistry of Materials* (McGraw-Hill); Davis, *Chemistry of Explosives; Bulletins of the U.S. Bureau of Mines, Canadian Bureau of Explosives* and other pamphlets.

Lecture—Wednesday, at 10, in Ontario Hall.

Professor Goodwin.

INDUSTRIAL CHEMISTRY II.

For students in Courses B and D, third year.

The lectures deal with the following topics: wood, coal and other fuels; water for steam raising and drinking purposes; the petroleum industry; industrial gases, gas producers, by-product coke and illuminating gas; sulphuric acid, alkali and ammonia; hydrochloric, nitric and acetic acids, acetone; electric furnace products, fertilizers, explosives and artificial silk, manufacture of wood pulp.

In the laboratory typical processes, such as dissolution, crystallization, water and gas analysis, ordinary and fractional distillation, preparations involving incomplete chemical reaction, are studied, emphasis being laid on systematic records and interpretation of results.

Text-books—E. R. Riegel, *Industrial Chemistry;* J. R. Partington, *Inorganic Chemistry* (Macmillan).

Handbooks—Hodgman-Lange, *Handbook of Chemistry and Physics* (Chemical Rubber Co.); or Lange, *Handbook of Chemistry* (Handbook Publishing Co.).

Lectures—Tuesday and Thursday, 10-11, Ontario Hall.

Laboratory—D, *Saturday,* 9-12, first term; *Monday,* 10-12, second term;
B, *Tuesday,* 1-4.

Professors Goodwin and Revell.

Industrial Chemistry IIIa.—Advanced.

For students in Course B, fourth year—first term.

This course deals with the following subjects: Distillation and dephlegmation, wood distillation, alcohol, acetic acid, acetone. Manufacture of organic nitro compounds and explosives. Equilibrium and optimal conditions for contact sulphuric acid, synthetic ammonia and nitric acid processes. Catalytic reactions in industry and high pressure syntheses. The absorption of gases by liquids and solids, absorption and reaction towers, potash manufacture and recovery, recovery of waste acids, sulphite, sulphate and mechanical wood pulp.

Text-books—E. R. Riegel, *Industrial Chemistry;* Badger and Baker, *Inorganic Chemical Technology;* assigned reading from Maxted, *Catalysis and its Industrial Applications;* and other publications.

Lectures—Wednesday and Friday, at 11, in Ontario Hall.

Laboratory—Monday, 1-4.

Professor Goodwin.

Industrial Chemistry iv.

Research Training

For graduate students and students in Course B, fourth year, electing thesis option in Industrial Chemistry.

Professor Goodwin.

Chemical Engineering i.

For students in Course D, third year.

A preparatory course in stoichiometrical and plant calculations, and in problems in Applied Physical Chemistry.

Text-books—Hodgmann-Lange, *Handbook of Chemistry and Physics* (Chemical Rubber Co.), or Lange, *Handbook of Chemistry* (Handbook Publishing Co.); Hitchcock and Robinson, *Differential Equations in Applied Chemistry* (Wiley).

Lecture and Laboratory—Thursday at 11, *Friday* at 10, second term.

Professor Goodwin.

Chemical Engineering ii.

For students in Course D, fourth year.

Industrial Processes—The topics dealt with are similar to those under Industrial Chemistry III (a), with the addition of: Plant for nitric acid manufacture, the influence of heats of reaction. Dissolution, decantation, filtration, centrifugals. The moving of gases, liquids and solids. The measurement of gases, and their absorption by liquids and solids. Absorption and reaction towers, their design and the study of filling materials. The manufacture of nitro compounds, the concentration of weak acids and the recovery of waste acids.

Pulp, Paper and Synthetic Plastics—Absorption principles and sulphite towers. The manufacture of mechanical and sulphite wood pulp. The Kraft or Sulphate, and the soda process, modern methods of causticising, washing, and of lime, soda and heat recovery. The manufacture of gun-cotton, cordite, nitro-cellulose powder, celluloid, viscose or artificial silk, and other synthetic colloids.

A collection of industrial products and apparatus is available for demonstration, and visits are paid to outside chemical works in the final year, at which attendance is required.

Designing of Chemical Plant. Calculations and exercises in designing chemical plant and factories. Considerations underlying the choice of materials of construction, acid proof containers and cements. Manufacturing costs as dependent on the cost of plant, raw materials, labour, etc.

Text-books—Partington, *The Alkali Industry;* Badger and McCabe, *Elements of Chemical Engineering;* Hougen and Watson, *Industrial Chemical Calculations;* Davis, *Chemistry of Explosives;* Badger and Baker, *Inorganic Chemical Technology.*

Assigned reading from Maxted, *Catalysis and its Industrial Applications;* Davis, *Handbook of Chemical Engineering;* Lunge, *Sulphuric Acid and Alkali;* and original publications.

Lectures—Wednesday and *Friday,* 11 a.m., first term; *Friday* and *Saturday,* 11-12, second term.

Laboratory—Saturday, 9-12, first term; *Wednesday,* 1-4, second term.

Professor Goodwin.

Chemical Engineering III.

For students in Course D, fourth year.

A detailed study of apparatus and chemical engineering plant, based on the chemical and physical conditions underlying the various processes. The elaboration in the laboratory of the best working conditions for a given chemical process.

The designing and drawing of parts of a chemical plant, based on experimental results worked out in the laboratory. Experimental work with semi-plant scale chemical engineering apparatus. Fuel and heating calculations. The gas producer. Materials of construction, stainless steels and their uses, alloys for high pressure work, etc.

The practical work will be divided between the laboratory and the draughting room as is found necessary.

Assigned reading from Davis, *Handbook of Chemical Engineering;* Lunge-Cummings, *Sulphuric Acid and Alkali;* and published papers and pamphlets.

Reference books—Perry, *Chemical Engineers' Handbook; Handbook of Chemistry and Physics.*

Lectures—Monday, 11-12, *Tuesday,* 3-4, first term; *Monday,* 11-12, second term.

Laboratory—Monday, 1-4 (a), 1-5 (b), *Friday,* 9-11.

Professors Goodwin and Revell.

Chemical Engineering iv.

For students in Course D, Fourth Year.

In the first term the lectures cover the metallurgy of iron and steel and some of the common metals, and non-rusting and other alloys of importance to chemical industry.

In the second term an introduction to dimensional analysis and graphical presentation is given and illustrated with chemical engineering problems in fluid flow and heat transmission.

Lectures include the processing of raw materials in chemical plants and the necessary apparatus together with the methods and instruments used for control.

Texts—Badger and McCabe, *Elements of Chemical Engineering;*
Rosenholtz, *Elements of Ferrous Metallurgy.*

Reference Text—Perry, *Chemical Engineers' Handbook.*

Lectures—Thursday, 11-12, first term; *Tuesday* and *Wednesday,* 11-12, *Thursday,* 10-11, second term.

Professor Revell.

Chemical Engineering v.

For students in Course D, fourth year.

The applications of thermodynamics to practical problems in Chemical Engineering.

Text—Weber, *Thermodynamics for Chemical Engineers.*

Lectures—Thursday, 9-10; *Tuesday,* 11-12, first term, one hour to be arranged.

Professor Revell.

LABORATORY OF CHEMICAL ENGINEERING.

The laboratory is provided with large size models of steam-jacketed evaporating pans, porcelain lined and fitted with stirring gear, with a steam-jacketed rectifying column and still, a steam-jacketed vacuum evaporator, pump and condenser, a jacketed vacuum shelf dryer, a high pressure acid proof filter, a Sweetland self-dumping filter press with sludge tank and centrifugal pump, a Sperry plate and frame filter press, a model stream-line filter, an ordinary and a high speed centrifuge, a rotating high pressure autoclave, and with other technical apparatus. Apparatus is being installed for high pressure synthesis, up to 100 atmospheres.

There is further installed a large reaction tower of earthenware designed for experiments in recovering smelter and other fumes or gases, connected to a fan, circulating and measuring devices, and with selected types of earthenware filling material.

Instruction in this laboratory is planned to train the student to handle fairly large quantities of material and to become familiar with standard types of technical chemical apparatus, to work out the experimental methods required for attacking a manufacturing problem, and to translate the laboratory results obtained into practice.

CIVIL ENGINEERING.

PROFESSOR—D. S. Ellis, B.Sc., M.A., M.C.E.
ASSISTANT PROFESSOR—R. A. Low, B.Sc., M.C.E.
ASSISTANT PROFESSOR—J. B. Baty, B.S. (on leave of absence)*
ASSISTANT PROFESSOR—C. V. Armour, M.A.Sc.
ASSISTANT PROFESSOR—S. D. Lash, M.Sc., Ph.D., A.C.G.I.
LECTURER—J. D. Lee, B.Sc., M.S.
SPECIAL LECTURER—O. T. Macklem, B.Sc.
DEMONSTRATOR—C. H. Ellacott, B.Sc.

GENERAL ENGINEERING I.

For students in all Courses second year.

This subject embraces the physical properties of materials used in the different branches of engineering and the principles involved in the theory of beams, columns, and structures.

MATERIALS OF CONSTRUCTION—Physical properties of Engineering materials and methods of testing. Commercial shapes of materials.

STRESSES IN FRAMED STRUCTURES—Analysis of stresses in roof and bridge trusses under static and moving loads.

GRAPHICAL STATICS—Graphical representation of stress; funicular and force polygons.

MECHANICS OF MATERIALS—Resistance and elasticity of materials; stress and strain diagrams; bending and shearing forces; torsion in shafting; deflection of beams; columns and struts; riveted joints; centres of gravity and moments of inertia.

Text-book—Timoshenko and MacCullough, *Elements of Strength of Materials.*

Books of Reference—Seeley, *Resistance of Materials;* Moore, *Materials of Engineering.*

Lectures—Monday and Friday, 9-10, ABCDM; *Monday,* 10-11, Sections 1-6, EFG; *Tuesday.* 11-12, Sections 7-12, EFG; *Wednesday,* 8-9, Sections 1-6, EFG; *Friday,* 10-11, Sections 7-12, EFG.

Professors Ellis, Armour and Lash.

GENERAL ENGINEERING II.

Theory of Structures

For students in Course E, Third Year.

This course forms the basis for the design and analysis of structures. The subjects considered include: Stresses in statically determinate framed structures, bending moments in continuous and restrained beams, elastic curves, influence lines, simple cases of redundant frameworks, combined stresses.

Text-book—Timoshenko and MacCullough. *Elements of Strength of Materials.*

Books of Reference—Spofford, *Theory of Structures;* George and Rettger, *Mechanics of Materials.*

Lecture—Tuesday, 11-12 (a); *Tuesday,* 9-10 (b).

Professor Lash.

* Lieutenant, United States Army Sanitary Corps—active service.

General Engineering III.

For students in Courses A, D, M, E, F, G, third year.

This course consists of practical work in the testing laboratory. Its object is to give the student a knowledge of the properties of engineering materials and of standard test methods.

The materials tested include wood, steel and other metals, and concrete.

Reference—Moore, *Materials of Engineering.*

Laboratory—Monday afternoon, alternate weeks all year. Courses A, E *and* G 1-3; *Courses* F, D *and* M 3-5. (*Note—Alternate Monday afternoons—Thermodynamics I.*)

Professor Lash, Mr. Lee, Mr. Law.

General Engineering IV.

For students in Course E, fourth year.

A continuation of the work of General Engineering III. Tests are made of concrete aggregates, reinforced concrete beams, masonry units, plywood, and other structural materials. Photo-Elastic methods of stress analysis are demonstrated.

Laboratory—Tuesday, 1-4, first term.

Professor Lash.

General Engineering V.

For students in Courses A, D, F, M, third year.

A course designed to give the non-structural student a knowledge of the fundamental principles involved in the design and detail of simple structures, in timber, steel and reinforced concrete. The theory applicable to columns, beams, slabs, riveted connections, brackets, retaining walls, trusses, trestles, water towers, and head-frames is discussed in the lectures and employed in the draughting room.

Text-books—National Lumber Manufacturers Association, *Wood Structural Data,* Vol. I; American Institute of Steel Construction, *Steel Construction;* American Concrete Institute, *Reinforced Concrete Design Handbook.*

Reference books—Young, *Structural Problems; National Building Code;* Seely, *Resistance of Materials;* George and Rettger, *Mechanics of Materials;* Parker, *Simplified Design of Roof Trusses for Architects and Builders;* Johnson, Bryan and Turneaure, *Modern Framed Structures,* Part 1.

Lectures—Wednesday, 9-10, D, F; *Wednesday,* 11-12, A, M.

Draughting—Thursday, 2-5, A, M; *Friday,* 1-4, D, F.

Professor Armour, Professor Lash, Mr. Lee.

General Engineering VI.

For students in Course E, third year.

Graphical Representation. Representation of engineering formulae and data. Progress and cost diagrams, interpretation of diagrams, solution of problems by means of diagrams.

Graphical Statics. Continuation of work in General Engineering I., with relation to roofs, bridges, arches, reinforced concrete and other structures.

Text-book—Wolfe. *Graphical Analysis.*

Reference Text—Marshall, *Graphical Methods.*

Lecture—Friday, 8-9 (a).

Draughting—Wednesday, 1-4 (a). Professor Low.

Foundations

For students in Course E, third year.

This course covers Soil Investigations, Stress Distribution in Soils, Bearing Capacity of Soils. Soil Pressures and Stability of Slopes. Approved methods of construction of footings, piling, cofferdams, caissons for foundations of buildings, abutments, piers, dams and retaining walls are outlined and typical design problems, quantity estimates and costs are assigned for class and drafting room.

Text-books and books of reference—Jacoby and Davis, *Foundation of Bridges and Buildings;* Plummer and Dore, *Soil Mechanics and Foundations;* Cain, *Earth Pressure.* Assigned references for reading.

Lectures—Tuesday, 11-12 (b).

Drafting Room—Wednesday, 1-4 (b).

Professor Low.

Structural Engineering I.

Elementary Structural Design.

For students in Course E, third year.

This course provides an introduction to structural design.

The materials considered are timber, steel and reinforced concrete. Attention is directed primarily to the proportioning of members such as beams and columns and to the arrangement of connections and splices.

In the draughting room students are required to design and detail structures and structural members.

Text-books—National Building Code, A.I.S.C., *Steel Construction;* Urquhart and O'Rourke, *Design of Concrete Structures.*

Books of Reference—U.S. Forest Products Laboratories, *Wood Handbook; Joint Committee Report—1940;* Grinter, *Design of Modern Steel Structures.*

Lectures—Thursday, 9-10 and *Friday,* 10-11.

Draughting—Thursday, 1-4.

Professor Lash.

Structural Engineering II.

For students in Course E, fourth year.

The theory of design for continuous beams, two-way reinforcement and flat-slab construction is discussed. The fixed arch and the rigid frame are analysed by the elastic theory. The methods of slope-deflection, moment-distribution and model analysis are also studied. Foundations, costs and estimates of quantities are studied as a part of the problems of design in the draughting room.

In the draughting room the student is required to design bridges and buildings in accordance with prevailing specifications and check some of his results by reaction gauges.

Text-books—Urquhart and O'Rourke, *Design of Concrete Structures, Joint Committee Report, 1940,* and *C.E.S.A. Concrete and Reinforced Concrete, 1942.*

Reference books—Taylor, Thompson and Smulski, *Concrete, Plain and Reinforced,* Vols. I and II; Hayden, *The Rigid Frame Bridge;* Pulver, *Construction Estimates and Costs.*

Lectures—Monday, 1-2, *Thursday,* 10-11, first term; *Tuesday,* 10-11, *Thursday,* 10-11, second term.

Draughting—Monday, 2-4, first term; 1-4, second term; *Friday,* 1-4.

Professor Armour.

Structural Engineering IV.

For students in Course E, fourth year.

Lectures—A course of lectures relating to the theory of design as applied to riveted truss highway and railway spans, arches, suspension bridges and movable spans. Deflections and secondary stresses are discussed and the methods of Single Integration, Moment Area, Slope-deflection, and Least-Work as applied to stress deformation is studied. The use of models to determine stress with deformeter gauges and polarized light is introduced. Elementary problems in applied elasticity are discussed.

Draughting room—Projects consist of the design and detail of structures studied in the lectures. Models are made of a frame that has been designed by an accepted theory and the model stressed and results compared to the analytical figures.

Text-books—

Johnson, Bryan and Turneaure, *Modern Framed Structures, Pt. II.*

A.I.S.C. Steel Construction.

Books of Reference — Sutherland and Bowman, *Structural Design;* Johnson, Bryan and Turneaure, *Modern Framed Structures, Pt. III;* Timoshenko and Lessells, *Applied Elasticity;* Parcel and Maney, *Statically Indeterminate Stresses.*

Lectures—Monday, 10-11 first term, *Thursday,* 11-12.

Draughting—Wednesday 1-4, *Friday,* 10-12.

Professor Armour.

Hydraulic Engineering I.

For students in courses E, F, G, third year.

Application of hydrostatic pressure in the case of dams, gates and pipes. Flow of water and other fluids and measurement of volume by various orifices and weirs. Flow in open channels, ditches, flumes, etc., and the use and application of these conductors of water. Flow through tubes and pipes. Use of pipes as conductors of supply for domestic and power purposes. Dynamic and static pressure as applied to motors for power purposes. Study of flow of liquids other than water.

Experiments to cover above principles.

Text-book—Ellis, *Hydraulics.*

Reference books—King and Wisler, *Hydraulics;* A. H. Gibson. *Hydraulics;* Addison, *Hydraulic Measurements.*

Lectures—Tuesday, 9-10 (a), *Friday,* 11-12 (b), *Wednesday,* 8-9.

Mr. Lee.

Hydraulic Engineering II.

For students in E, F, and G, fourth year.

Comprises the study of centrifugal pumps, fans and hydraulic turbines; the elements of hydrology, the design and construction of dams and appendages; measurement, development and transmission of water power; the design of hydraulic power plants:

Problems in relation to these subjects.

Text-book—Ellis, *Hydraulics.*

Reference books — Creager and Justin, *Hydroelectric Hand Book;* Schoklitsh, *Hydraulic Structures; Air Conditioning and Engineering;* Daugherty, *Centrifugal Pumps;* Angus, *Hydraulics.*

Lectures—Monday, 10-11 and *Thursday,* 9-10, F., *Wednesday,* 9-10, *Friday,* 9-10, E. G.

Professor Ellis.

Hydraulic Engineering III.

For students in Courses E, F, G., fourth year.

Work in Hydraulics Laboratory on selected experiments dealing with hydrostatic pressure, orifice, and weir flow, flow through pipes and open channels, loss in valves and pipe fittings, efficiency tests on centrifugal pumps, and reaction and impulse turbines. Investigation of flow in draft tube. Air flow in ducts. Tests on fans. Studies on air foils, etc., in wind tunnel.

Laboratory—Wednesday, 1-4 G, first term. *Saturday,* 9-12 E, second term.
F—*Tuesday,* 1-4, second term.

Professor Ellis, Mr. Lee.

Hydraulic Engineering IV.

For students in Courses A, D, M, of fourth year.

Hydrostatics as applied to dams, gates, pipes, etc. Flow of water and other liquids through orifices, pipes, and channels; centrifugal pumps; hydraulic models; air flow; fans; ventilation problems on mines and buildings.

Demonstration of experiments in Laboratory.

Text-book—Ellis, *Hydraulics.*

Reference books—Montgomery, *Theory and Practice of Mine Ventilation;* Weekes, *Mine Ventilation.*

Lectures—Thursday, 10-11, (a and b); *Friday,* 8-9 (a); *Tuesday,* 10-11 (b).

Professor Ellis.

Railway and Highway Engineering

For students in Course E, third year.

Economics of railway and highway location, effects of distance, curvature, and grades on operation. The paper location of a railway or highway; estimate of grading costs; subgrade drainage; and construction methods. Haul and the economic selection of equipment. Materials of construction, including elementary soil mechanics.

Text-books—Webb, *Railroad Construction;* Bateman, *Highway Engineering.*

Books of Reference—Plumber and Dore, *Soil Mechanics and Foundations; American Highway Engineers' Handbook.*

Lecture—Monday, 11-12, *Thursday,* 10-11.

Draughting Room—Friday, 1-4. Professor Low.

Engineering Relations

For students in Course E, fourth year.

A composite course arranged to acquaint the student with the legal relations and business methods pertaining to the engineering profession, including the essential principles of contracts and specifications, cost analysis, valuation and cost keeping, and to develop ability for proper oral and written expression and an appreciation of ethical and personal relations.

Text-book—Kirby, *Elements of Specification Writing.*

Books of reference—Gillette and Dana, *Construction Cost Keeping and Management;* Fish, *Engineering Economics;* Mead, *Contracts, Specifications and Engineering Relations.*

Lecture—Tuesday, 9-10.

Professor Armour.

Municipal and Sanitary Engineering I.

For students in Course E, third year.

Sewerage—A study of the factors affecting the sewerage plan, methods of estimating future population, quantity of domestic sewage, rainfall and method of estimating run-off producing storm water flow, the hydraulics of sewers, the design of sewer systems, sewer appurtenances, and sewer construction.

Water Supply—A study of the quantity of water required for public supplies, sources of supply—surface and ground waters, quality of water from various sources and reliability to meet the demand, works for the collection and distribution of water.

Computations—Problems on population estimates, rainfall intensity and frequency. Design of a separate sewer system and storm water drains.

Text-books—Babbitt, *Sewerage and Sewage Treatment;* Waterman. *Elements of Water Supply Engineering.*

Lectures—Monday, 10-11 and *Tuesday,* 10-11, second term.

Computing Period—Tuesday, 1-4, second term.

Mr. Lee.

Municipal and Sanitary Engineering II

For students in Course E, Fourth Year.

Water Supply—A study of the relationship of public water supplies to public health, quality of natural waters, factors affecting natural purification, sanitary surveys, interpretation of water analyses, water purification and treatment processes, works for the purification of water, the design of purification and treatment units and examination of accessory mechanical devices, operation of water purification and treatment plant units, governmental control over quality of public water supplies.

Municipal Administration—Organization of municipal governments, functions of the office of city engineer, municipal financing.

Laboratory work includes the performance of chemical and bacteriological tests on water to determine its natural quality, a study of operation of model rapid sand gravity filters and a slow sand filter, tests to determine effectiveness of treatment processes, corrective and control measures. Inspections of municipal filtration plants may be arranged.

Text-book—Waterman, *Elements of Water Supply Engineering.*

Books of reference — Babbit and Doland, *Water Supply Engineering;* Steele, *Water Supply and Sewerage;* Hardenbergh, *Water Supply and Purification;* American Water Works Association, *Manual of Water Treatment;* American Public Health Association, *Standard Methods of Water and Sewage Analysis;* Turneaure & Russell, *Public Water Supplies.*

Lecture—Monday, 11-12.

Laboratory—Thursday, 1-4 (in part).

Mr. Lee.

Municipal and Sanitary Engineering III

For students in Course E, fourth year.

Sewage Treatment and Disposal. A study of the characteristics and behaviour of domestic sewage, principles and processes of sewage treatment, factors governing the selection of a single process or combination of processes, the design of sewage treatment plant units and examination of accessory mechanical devices, operation of sewage treatment plant units, governmental control over installation and operation of municipal sewage treatment plants in regard to pollution of streams, lakes and other natural bodies of water.

Treatment and Disposal of Industrial Wastes.

Municipal Sanitation. A study of the methods of collection and disposal of garbage and other municipal refuse; municipal incinerators.

Laboratory work includes the performance of chemical and bacteriological tests on domestic sewage to determine its characteristics, a study of operation of model sewage treatment plant units and accessory mechanical devices, tests to determine effectiveness of treatment processes and quality of final effluent, corrective and control measures. Inspections of municipal sewage treatment plants may be arranged.

Text-book—Babbitt, *Sewerage and Sewage Treatment.*

Books of reference—Steel, *Water Supply and Sewerage;* Imhoff and Fair, *Sewage Treatment;* Hardenbergh, *Sewerage and Sewage Treatment;* American Public Health Association, *Standard Methods of Water and Sewage Analysis;* Metcalf and Eddy, *American Sewerage Practice,* Vol. III.

Lecture—Tuesday, 11-12.

Laboratory—Thursday, 1-4, (in part).

Mr. Lee.

NOTE—Laboratory work in Municipal and Sanitary Engineering II and III and Highway Engineering has been arranged for one period of three hours per week, Thursday, 1-4.

Graduate Course in Municipal and Sanitary Engineering

(Discontinued for the duration of the War.)

Directed Special Studies

Sanitary Engineering Design—Design of special structures relating to water supply and sewer systems, water purification and sewage treatment plants, and refuse incinerators; Examination of plans and existing structures.

Sanitary Chemistry and Biology—Advanced studies of the chemical and biological factors involved in water purification and sewage treatment; Microscopy of water supplies; Chemical and bacteriological analyses of water and sewage in the laboratory.

WATER PURIFICATION AND SEWAGE TREATMENT—Advanced studies of all processes; Mechanics of operation of purification and treatment plant units and accessory devices; Laboratory tests for determining degree of treatment, and plant efficiency; Corrective and control measures; Plant records; Inspections of municipal plants.

TREATMENT OF INDUSTRIAL WASTES—A study of the methods of treating various kinds of industrial wastes separate from domestic sewage.

MUNICIPAL ENGINEERING—Municipal Administration and financing; Functions of the office of City Engineer; Municipal Sanitation:—Refuse collection and Disposal, Plumbing.

PUBLIC HEALTH ENGINEERING—Sanitary Surveys; Protection of all public water supplies; Protection of bodies of water used for recreational purposes or harvesting of shellfish; Stream pollution investigations and control; Water-borne diseases and statistical information on water-borne disease epidemics; Swimming pool sanitation; Rural Sanitation; Functions of Engineering Bureaus of Government Health Departments; Government Health Departments' Standards relating to quality of Public Water Supplies and Rules and Regulations governing design of water supply and sewerage projects and operation of water purification and sewage treatment plants; Public Health Laws, Sanitary Codes and Court cases relating to violations.

CURRENT LITERATURE ON SANITARY ENGINEERING.

Special articles in current proceedings of water and sewage works associations and engineering journals.

RESEARCH AND THESIS on some special subject in Sanitary Engineering.

Professor Baty.

HIGHWAY ENGINEERING II.

For students in Course E, fourth year.

Development and classification of road and street types; design, methods of construction, and maintenance. Stabilization of road subgrades and surfaces. Economic selection of surface types. Treatment and design of Intersections and grade separations. Elements of traffic engineering. Highway planning, financing, and administration.

Soil Mechanics Laboratory—Materials testing; soils, aggregates and bituminous materials. Assigned problems in design of graded mixes, embankment compaction and soil stabilization.

Text-book—Bateman, *Highway Engineering.*

Books of reference—Agg, *Construction of Roads and Pavements;* Plummer and Dore, *Soil Mechanics and Foundations; Traffic Engineering Handbook; Publications,* Bureau of Public Roads and Highway Research Board.

Lecture—Wednesday, 11-12.

Laboratory—Thursday, 1-4, (in part). Professor Low.

Surveying.

All branches of Surveying receive full consideration. During the outdoor instruction students are given every opportunity to become familiar with the instruments. Notes of all field work are plotted in the draughting-room, and the rules and regulations for field work and instruments-room must be strictly adhered to. Students must be engaged in the work of a class in the hours set apart for it, otherwise their attendance will not be counted. Attendance and character of work done will be considered in the class standing.

Surveying I.

Required of all first year students.

The description, use, adjustment and care of chains, tapes, compasses, levels, transits and minor surveying equipment. Methods employed in elementary surveying.

The practical work in the field and draughting rooms is an important part of this course.

Text-book—Breed, *Surveying.*

Books of reference—Davis and Foote, *Surveying Theory and Practice;* Davis, Foote, and Rayner, *Surveying;* Breed and Hosmer, *Elementary Surveying.*

Lecture—(Field Work), Sects. 1-2, *Friday,* 1-3, Sects. 3-4, *Monday,* 1-3. Sects. 5-6, *Friday* 9-11, Sects. 7-8, *Monday,* 9-11.

Professor Macklem, Mr. Ellacott.

Surveying II.

For students in all courses, second year.

It continues the work of Surveying I, and includes Land Surveying—Route Surveying—profiles, circular and vertical curves, earthwork; Topographic Surveying—with stadia, plane table, hand level, and transit and level; Hydrographic Surveying — Methods, sextant, river surveying, stream flow; Laying out of buildings and engineering construction. Underground Surveying. Observations for Azimuth. Errors.

Text-books—Davis and Foote, *Surveying Theory and Practice;* Breed, *Surveying.*

Lecture—A, B, C, D, M, *Friday,* 10-11; E, F, G, (1-6), *Tuesday,* 8-9; E, F, G, (7-12), *Monday,* 10-11.

Field Work and Draughting—A, B, C, D, M, *Wednesday,* 8-11; E, F, G, Sections 1-6, *Tuesday,* 9-12; Sections 7-12, *Tuesday,* 1-4.

Professor Low, Mr. Ellacott.

Surveying III.

For students in Course E, third year, first term.

Topographic Surveying, Stream Measurement, Hydrographic Surveying, Mine Surveying, Base Line Measurement, Triangulations, Adjustment of

simple figures, Computation of coordinates, Map Projections; Precise levelling; Observations for Azimuth, Latitude, Time. Introduction to adjustment of observations. Outlines of D.L.S. and O.L.S. systems. Descriptions.

PRACTICE. Field work taken at Field Survey class which is prerequisite.

Text-book—Davis, Foote and Rayner, *Surveying.*

Lecture—Wednesday, 10-11, first term.

Field Work and Draughting—Tuesday, 1-4, first term.

Professor Ellis.

SURVEYING FIELD WORK

The class in surveying field work is intended to give the third year students in courses A, C and E an opportunity to become familiar with instruments and methods of survey under conditions approximating those of commercial work. It is prerequisite for Surveying III.

The syllabus covers field work on the following lines, simple triangulation, base lines, stadia, plane table, location of engineering structures, land boundaries and possibly soundings and stream measurements; azimuth observations on sun and polaris, mine surveying.

In rotation each student will take charge of his own party and ability to organize and direct work will in part determine his standing.

Individual copies of the notes will be prepared day by day by the note recorders of each party. These will be used later in preparing plans, etc. Observations, etc., will be worked out as taken.

The work will be carried out in the vicinity of Kingston. Transport will be arranged by the department. Students will need to carry lunches on most days. Each student will require tables, etc., and *a reading glass is compulsory.*

Students intending to take this class are required to notify the Registrar not later than August 1st.

The class work will commence at 9.00 a.m. on Monday, September 13th, and will end Saturday, September 25th.

Professor Low.

THESIS.

Fourth Year students in Civil Engineering are required to submit a thesis. The purpose of the work is to provide a training in collecting data and presenting it in fair literary style.

The subject of the thesis is to be from the field of Civil Engineering and the work may be the result of summer employment, library investigation or laboratory research. The title and a provisional outline of the proposed thesis must be submitted to the Civil Engineering Department not later than October 15th, and the completed work, in approved form, handed in on or before February 15th. Printed instructions are issued to each student in the Third Year.

Professor Ellis.

Laboratories.

The Civil Engineering Laboratories, used principally in the third and fourth years of the Course, consist of the following units.

The Materials Laboratory occupies the whole of the basement floor of Carruthers Hall, which has recently been rebuilt. There is a large room for concrete, with bin storage for raw materials and all the equipment needed for storing and curing the specimens. It is fully equipped with scales, "Rotap" machine, screens, etc., for analyses of sand and coarse aggregate, and there are two small mixers.

In the machine room adjacent to the concrete room. the following testing machines are placed—A Riehlé machine of 100,000 lbs., capacity, two Amsler hydraulic machines, each of 50,000 lbs. capacity, one of which has a long bed for beams, a 30,000 lbs. Olsen machine, a torsion machine of 6,000 in. lb. capacity and an Izod machine of 120 ft. lb. capacity.

A full assortment of gauges for use with these machines is available.

For examination of the hardness of metals a Brinell machine, and Shore Sclerometer are used.

Next the machine room is a dark room for work with the Photoelasticity apparatus on stress distribution in transparent models.

The Sanitary Engineering Laboratory in its own building on the water front is outstanding. It contains equipment for a small sewage plant to treat 70,000 gallons per day, a small rapid sand gravity filter, and a slow sand filter with a combined capacity of 68,000 gallons. There is a fully equipped analytic laboratory where students may acquire laboratory technique and a knowledge of processes. At the same time they have an opportunity to test actual plant operation and correlate their information with design of treatment units.

The Highway Laboratory, which occupies part of the new Sanitary Laboratory building, is equipped to carry out the standard tests for bituminous materials and aggregates used as highway construction materials. Facilities are also provided for the analysis and classification of soils and for experiments in the field of soil stabilization.

The Hydraulics Laboratory occupies its own building in the University Grounds. In the basement is a large tank and flume from which water may be pumped to any of the equipment. The equipment of the laboratory comprises four centrifugal pumps, and a Francis and Impulse turbine, two open channels for weirs and the usual pipe racks and orifice equipment. On the main floor of the same building is the Air Laboratory in which are two large and two small fans, with ducts of various sizes. A two foot open throat wind tunnel with balance is used for aerodynamic experiments.

Several sensitive gauges are available for measurement of low velocities.

ELECTRICAL ENGINEERING.

PROFESSOR—D. M. JEMMETT, B.Sc., M.A.
ASSOCIATE PROFESSOR—H. H. Stewart, B.Sc., M.S.
ASSISTANT PROFESSOR—H. S. Pollock, M.Sc.
DEMONSTRATOR—N. A. Williams, B.Sc.

ELECTRICAL ENGINEERING I.

FUNDAMENTAL PRINCIPLES

For third year students in Courses A, D, M, E.

The electric circuit. The magnetic circuit. Generated and induced electro-motive forces. Self and mutual induction. Elementary theory of alternating and direct current generators and motors. Common systems of transmission and distribution of electric current. General principles of illumination. Storage batteries.

Lectures—Monday, 10-11 (a); *Monday,* 9-10 (b); *Friday,* 9-10.

Laboratory—D, M, *Monday,* 1-3; A, and E, *Monday,* 3-5.

Professor Pollock and Mr. Williams.

ELECTRICAL ENGINEERING II.

For third year students in Courses G and H.

Alternating currents. The use of the complex quantity. Energy and power in A. C. circuits. Laws governing the flow of current in circuits containing resistance, inductance and condensance. The theory, construction and operation of the transformer. Meters and the measurement of electrical quantities.

Lectures—Wednesday, 9-10 (a); *Monday,* 9-10 (b); *Thursday,* 11-12.
Professor Stewart.

Laboratory—Tuesday, 1-4. Professor Stewart and Mr. Williams.

ELECTRICAL ENGINEERING III.

For third year students in Course G.

The electric and magnetic circuits, hysteresis and hysteresis loss. Measurement of magnetic quantities. Some simple transients. Theory of direct current generators and motors. Series, shunt and compound machines. Energy losses, efficiency and commutation, methods of control, storage batteries. Application of direct current in commercial work. Illumination and photometry.

Lectures—Monday, 9-10 (a); *Tuesday,* 10-11 (b); *Wednesday,* 11-12; *Thursday,* 10-11. Professor Jemmett.

Laboratory—Saturday, 9-12. Professor Jemmett and Mr. Williams.

Electrical Engineering IV.

For third year students in Course F.

The electric circuit. Continuous-current meters. Continuous-current generator and motor. Batteries. Illumination.

Lectures—Monday, 9-10 (a); *Thursday,* 11-12 (a); *Tuesday,* 10-11 (b); *Friday,* 10-11 (b). Professor Pollock.

Laboratory—Tuesday, 3-5. Professor Pollock and Mr. Williams.

Electrical Engineering V.

For fourth year students in Course G.

Theory of alternating current generators. Synchronous and Asynchronous Motors. Rotary Converters. Potential Regulators. Phase changing. Multiphase Systems. Transmission of power. Applications of alternating current in commercial work.

Lectures—Monday, 11-12; *Tuesday,* 9-10; *Thursday,* 11-12; *Friday,* 11-12 (a); *Friday,* 10-11 (b).

Professor Jemmett.

Laboratory—Thursday, 1-4; *Friday,* 1-4.

Professor Jemmett and Mr. Williams.

Electrical Engineering VI.

For third year students in Courses G and H.

Properties of electrons and their dislodgement from atoms of vapours, gases and solids. Physics of thermonic vacuum tube. Photo electricity. Gaseous rectifiers.

Lectures—Wednesday, 9-10 (b); *Thursday,* 9-10 (b).

Professor Pollock.

Electrical Engineering VII.

For fourth year students in Course F.

Fundamental principles of alternating-current circuits. Single phase and polyphase circuits. Study of the alternating-current generator, the transformer, the induction motor, the synchronous motor, single-phase motors, and rectifying devices.

Lectures—Monday, 11-12; *Wednesday.* 1-2. Professor Stewart.

Laboratory—Wednesday, 2-4. Professor Stewart and Mr. Williams.

Electrical Engineering VIII.

For fourth year students in Courses G and H.

Exact solution of transmission lines in the steady state. The general differential equation. Solution in hyperbolic functions. Free, grounded and

loaded lines. Nominal and Equivalent π and T lines. Constant voltage systems. Theory of Filters. Use of complex circular and hyperbolic tables and charts. Solution of power and telephone lines.

Lecture—Monday, 10-11.

Laboratory—Tuesday, 1-4 (a); *Wednesday,* 1-4 (b).

Professor Jemmett.

Electrical Engineering IX.

For fourth year students in Course G.

This course deals with the general principles and practical applications of radio. Time is also given to the study of protective relays, their use in A.C. and D.C. power systems and other related subjects.

Lectures—Thursday, 10-11 (b); *Friday,* 10-11 (a); *Wednesday,* 10-11.

Professor Pollock.

Laboratory—Saturday, 9-12.

Professors Stewart and Pollock.

Electrical Engineering X.

For fourth year students in Course G.

Design and Calculation of performance of transformers, generators and motors.

Lecture—Tuesday, 11-12.

Professor Jemmett.

Draughting Room—Monday, 1-4.

Electrical Engineering XI.

For fourth year students in Courses G and H.

A special course in ultra short wave radio.

Lecture—Tuesday, 11-12 (a), 10-11 (b).

Laboratory—Monday, 1-4. Professor Stewart.

Electrical Engineering XII.

For fourth year students in Courses G and H.

A course for the study of the various types of electron tubes and their applications. The three-electrode vacuum tube as an amplifier, oscillator, detector and modulator. Special types of vacuum tubes. Application of electron tubes to radio, wire telephony and power.

Lectures—Wednesday, 10-11; *Thursday,* 10-11. Professor Stewart.

Laboratory—Saturday, 9-12. Professors Stewart and Pollock.

Electrical Engineering Laboratories.

Laboratories Nos. 1, 2, 3 and 4 are equipped with standard types of direct and alternating current machines which include synchronous motors and

generators, rotary converters, polyphase induction motors, repulsion and compensated induction motors, constant current transformers, series and potential transformers, power transformers, direct current shunt, series and compound wound machines. A complete set of rheostats and brakes with all necessary meters are available for determining the performance of these machines.

Laboratory No. 5 is the radio laboratory and is equipped with power supplies of all kinds necessary for vacuum tube experiments, audio frequency oscillators and calibrated attenuators, vacuum tube voltmeters, a signal generator and output meter for measuring receiver characteristics, a distortion and noise measuring set, two audio frequency bridges for measurement of resistance, inductance and capacity and all necessary meters. A magnetic and a cathode ray oscillograph are available for wave form study.

Laboratory No. 6 contains the experimental broadcasting station CFRC.

Laboratory No. 2 contains the storage battery, balancer and booster control panels and a transformer giving voltages up to 100,000 volts. A sphere gap voltmeter is available for measuring high voltages.

Power is available from the University Plant at 220/110 volts D.C. direct or through a motor—generator set which delivers power at 120/60 volts D.C. and 2 phase 85 volts 25 cycles A.C. A 125 volt, 200 ampere hour storage battery and city power at 3 phase 220/110 volts 60 cycles are also provided.

A large number of circuits which have terminals in the various laboratories enable power to be easily transferred from any machine to any other machine.

The University Power Plant is a combination direct and alternating current system making available for study and observation such apparatus as D.C. generators, synchronous motors, Tirril regulators, balancer sets, storage batteries, power transformers, watthour meters, boosters, switchboard apparatus, etc.

The City of Kingston has a new and up-to-date hydro-electric station, to which visits are made for instruction and observation.

MECHANICAL ENGINEERING.

Professor—Major-General E. Schmidlin, M.C.
Associate Professor—L. T. Rutledge, B.A.Sc., M.E.
Assistant Professor—W. A. Wolfe, M.Sc.
Lecturer—H. G. Conn, B.Sc. (on active service).*

Mechanical Engineering I.

Elements of Machine Design

For students in Courses F and G, third year.

This course covers the following: characteristics and properties of materials used in machine industries; simple and combined stresses; principles

* Major, Royal Canadian Ordnance Corps, Overseas.

governing design for strength, safety, rigidity, and endurance; analysis of stresses in and design of pressure vessels, fastenings, shafts, shaft coupling, clutches, fly wheels, frames of machines, brackets, welded structures and designs of various typical machine parts and compound members.

Text-book—Vallance, *Design of Machine Members.*

Lectures—Monday, 10-11; *Tuesday,* 11-12.

Professor Rutledge.

Mechanical Engineering II.

Transmission of Power and Machinery.

For students in courses F, G, third year.

The work in this class consists of analyses of stress and design of power transmission systems, comprising belt, rope, chain and gear drives; study of couplings, friction clutches and brakes. Dynamics of Machinery including speed fluctuations in machinery, kinetic energy of machines, inertia, proper weights of flywheels, accelerations in machines and their effects. Disturbing forces: stresses due to inertia, balancing of machinery.

Text-books—*Design of Machine Members,* by Vallance; *Theory of Machines,* by Angus; Mark's *Mechanical Handbook.*

Lectures—Monday, 11-12; *Tuesday and Friday,* 9-10, second term only.

Professor Rutledge.

Mechanical Engineering III

Practical Machine Design.

For students in course F, third year.

This course is a practical application of the work taught in Mechanical Engineering I and II. It is given conjointly with Mechanical Engineering VII, on Thursdays, from 1.00 to 4.00 p.m.

This course also covers a study of machine-shop practice, of basic machining operations, and of manufacturing processes. The course treats of tool engineering, and includes the design and operation of cutting tools, jigs, fixtures, machine dies and cams. This portion of the course is given on Wednesdays, from 1.00 to 4.00 p.m.

Lectures and draughting exercises—Wednesday, 1-4; *Thursday,* 1-4.

Professor Rutledge.

Mechanical Engineering IV.

Elementary Heat Engineering

For students in Courses A, E, and G, fourth year.

This course is largely of a descriptive character, and is intended to give the general idea of Heat Engineering to students not taking the Mechanical Engineering course. It comprises instruction in the parts of steam power plants and their functions, the use of compressed air, the use of internal-combustion engines as power plants, the principles of heating, ventilating and air-conditioning, the principles and uses of producer-gas plants and the principles of fans, blowers and pumps.

Lectures—Thursday, 9-10, and *Tuesday,* 10-11 (a), 1-2 (b).

Major-General Schmidlin.

Mechanical Engineering V.

Advanced Machine Design

For students in Course F, fourth year.

This course covers a more intensive treatment of Machine Design and the theory and evaluation of stress. It includes studies of the following: theory and design of curved beams, crane hooks and curved frames; eccentricity of loading; struts and tie-bars axially and transversely loaded; mining machinery such as mine hoists, cars, skips, and conveying equipment; automobile parts; spiral and worm gearing; manufacturing processes and methods; aeroplane design including a brief study of the principles of Aeronautics and Aerodynamics necessary to understand the principles of flight.

Text-books—The general texts are the same as those listed in Mechanical Engineering I. Aeroplane Text—Wood, *Technical Aerodynamics.*

Lectures—Monday, 1-2; *Tuesday,* 10-11; *Wednesday,* 8-9.

Laboratory—Monday, 2-5; *Tuesday,* 1-4 (a).

Professor Rutledge.

Mechanical Engineering VI.

Design of Power Plants, Heating, Ventilating and Refrigeration.

For students in Course F, fourth year.

This course is the continuation of Thermodynamics V, in so far as steam power plants are concerned, and in this respect deals with the more advanced study of steam cycles, the selection of condensers and exhaust pressures, the selection of boiler and stoker types and of pressures and temperatures. It deals also with the study of re-heating and regenerative cycles, binary-vapor cycles, feed-water treatment and heating, the use of economisers and air heaters, the layout of power stations, etc. The economic aspect of the problem is emphasized throughout.

The course also includes the principles and practices of heating, ventilating and air-conditioning and the practical applications of refrigerating and ice-making machinery.

Text-books—Gaffert, *Steam Power Stations;* Allen and Walker, *Heating, Ventilating and Air Conditioning.*

Lectures—Thursday, 10-12 (a) and 10-11 (b).

Major-General Schmidlin.

Mechanical Engineering VII.

Practical Machine Design.

For students in Course G, third year.

This course is a practical application of work taken up in Mechanical I and II which courses are prerequisites of the course.

Draughting—Thursday, 1-4. Professor Rutledge.

Mechanical Engineering VIII.

Fuel Testing.

For students in Course F, fourth year.

This course comprises the testing, by standard methods, of solid, liquid and gaseous fuels, to obtain proximate analyses and calorific values. It also includes standard distillation tests of volatile fuels, and standard tests of lubricants, and the analysis of flue-gases and internal-combustion engine exhausts.

Laboratory—Saturday, 9-12.

Major-General Schmidlin and Professor Wolfe.

Mechanical Engineering IX.

Kinematics of Machinery

For students in Courses E, F, and G, second year.

This course treats of the theory of mechanisms and the kinematics of machinery. It also includes a treatment of the fundamental principles pertaining to the design of spur gears, gear trains and the proportioning of speeds with gears.

Text-book—Angus, *Theory of Machines.*

Lecture—Wednesday, 10-11.

Drafting—Sections 1-4, *Thursday,* 1-3; Sections 5-8, *Thursday,* 3-5; Sections 9-12, *Tuesday,* 8-10.

Major-General Schmidlin and Demonstrators.

Mechanical Engineering X.

Production Engineering

For students in Course F, fourth year.

This course includes lectures and draughting room exercises on factory planning and layout, equipment and services in buildings, machine foundations, building types, product design as affecting production. the planning and scheduling of machine operations, tolerances, the design of tools, jigs and fixtures, types and uses of automatic machines, time, motion and cost studies, selection of materials, etc.

Lectures and Draughting Room—Friday, 10-12 (a), 9-11 (b).

Major-General Schmidlin and Professor Wolfe.

Mechanical Engineering XI.

Internal Combustion Engines.

For students in Course F, fourth year.

This course consists of lectures on the basic theory of operation of all types of internal-combustion engines, and study of the effects on theoretical performance of practical design limitations. The methods of design of combustion spaces, valves and valve gear, ignition systems, carburetors, fuel pumps, etc., are also included.

Text-book—Lichty, *Internal Combustion Engine.*

Lectures—Wednesday. 10-12 (a), 10-11 (b); *Thursday,* 11-12 (b).

Professor Wolfe.

Mechanical Engineering XII.

A short course in the Elements of Machine Design for third year D and M students, and covering in general selected suitable portions of Mechanical Engineering I.

Lectures—Tuesday, 11-12 (a); *Thursday,* 8-9 (b).

Draughting—Wednesday, 1-4 (b). Professor Wolfe.

Thermodynamics I.

Elementary Engineering Thermodynamics

For students in Courses A. D, M, E, F, and G, third year.

This course includes a study of the following: thermodynamic media and their co-ordinates, energy factors, the energy equation, thermodynamic processes, properties of media and processes, mixtures of media, availability of energy, thermodynamic cycles.

Text-book—Lichty, *Thermodynamics.*

Lectures—Monday, 8-9.

Laboratory—Monday, 1-5 (in accordance with group and period arrangements as shown under General Engineering III.)

Major-General Schmidlin and Professor Wolfe.

Thermodynamics II.

Advanced Thermodynamics

For students in Course D, fourth year.

This course includes lectures and laboratory work in Applied Thermodynamics, in continuation of Thermodynamics I. The subjects covered include the flow of vapours and gases through pipes, nozzles, and orifices, the theory and practice of heat transfer, the application of thermodynamics to the study of practical methods of air compression, the application of thermodynamics to the study of refrigeration systems, and the thermodynamics of certain chemical processes in industry.

Text-book—Emswiler, *Thermodynamics.*

Lectures—Tuesday and Wednesday, 9-10.

Laboratory—Wednesday, 1-4 (a).

Major-General Schmidlin and Professor Wolfe.

Thermodynamics III.

Advanced Thermodynamics.

For students in Course F, fourth year.

This course is a continuation of Thermodynamics I, and includes lectures and laboratory work on the flow of vapours and gases through pipes, nozzles and orifices, flow through turbine blading, the principles of design of various

types of steam turbines, the thermodynamics of steam-engine cycles, engine efficiencies, the use of Steam Tables and Diagrams in the solution of problems, the application of thermodynamics to the study of practical methods of air compression, the application of thermodynamics to the study of refrigeration systems.

Text-book—Emswiler, *Thermodynamics.*

Reference works in the library.

Lectures—Tuesday and *Wednesday,* 9-10.

Laboratory—Thursday, 1-4, first term.

Major-General Schmidlin.

Thermodynamics IV.

Advanced Thermodynamic Laboratory Work.

For students in Course F, fourth year.

This course consists of tests on steam engines, steam turbines, and internal-combustion engines both gasoline and oil burning, also tests on complete steam cycles, including a standard A.S.M.E. test of a steam-generating plant. Lectures are also given on the practical operation and features of design and application of internal-combustion engines.

Text-books—A.S.M.E. Proceedings and Bulletins; Reference works on testing.

Laboratory—Friday, 11-12 (b) and 1-4.

Major-General Schmidlin and Professor Wolfe.

Thermodynamics V.

Elementary Power Plant Engineering.

For students in Course F, third year.

This course is a study of the fundamental principles underlying the design, construction, and operation of steam power plant equipment, in which reciprocating steam-engines are used for the generation of power. The marine power plant, particularly that of the merchant marine vessel, is included, together with land installations. The course includes intensive studies of steam-engines, both simple and multiple, steam boilers, feed water heaters, condensers, pumps, automatic regulating gear, steam piping and miscellaneous equipment, fuels and combustion, stokers, steam plant measuring instruments and equipment.

The course treats at length of the losses in the operation of steam-engines and plants, the causes of such losses and means of loss reduction, mathematical solutions for optimum conditions of length of steam admission, compression, back pressure and engine speed, and maximum economy of steam consumption.

Text-book—MacNaughton, *Elementary Steam Power Engineering.*

Lectures—Monday, 9-10 (b); 11-12 (a); *Wednesday,* 11-12.

Laboratory—Tuesday, 1-3.

Professors Rutledge and Wolfe.

Thermodynamics Laboratory

The Thermodynamics Laboratory is located at the Central Heating Plant on King Street. The Internal Combustion Engine section is equipped with a four cylinder high speed automotive type Diesel engine of modern design, two eight cylinder automobile engines of different designs, a single cylinder Diesel engine of nine horsepower and a motor-driven air compressor of fifty cubic feet capacity, two sectionalized automobile chassis of different makes. All engines are furnished with the necessary power-measuring brakes and other instruments for complete testing procedures. It is expected that two standard C.F.R. Test Engines, one for gasoline and the other for oil, will be added shortly.

The steam section includes two small steam turbines, one Uniflow engine, two simple steam-engines and a steam-driven air compressor. A surface condenser, with the necessary equipment for measuring cooling-water and steam quantities, is installed so that it can work in conjunction with any of the engines. Equipment is also installed for the measurement of flow, etc., of steam or air through nozzles, orifices, Venturi tubes and so on. Steam is provided from the boilers of the Central Heating Plant, the equipment of which is also available for demonstration and test purposes.

SHOP WORK

Instructors—A. C. Baiden, Machine Shop.
C. Brown, Blacksmith Shop and Welding.

For students in Courses E, F, and G, second year; Course F, third year; Course D, fourth year.

Students in courses F and G shall enter any commercial works approved by the School and take a special course of shop training extending over a period of thirty-six weeks (18 weeks between second and third, and 18 weeks between third and fourth college years); or, in case accommodation cannot be secured, they shall attend a special course in the workshops of the school, extending over a period of 8 weeks (4 weeks preceding their third college year and 4 weeks preceding their fourth college year).

A student in Course H shall enter any commercial works approved by the University and take a special course of shop training extending over a period of 12 weeks, between the second and third years of his course.

If a student enters a commercial machine shop to take his practical work, as indicated above, he must at the end of each term present a certificate from the manager of the plant stating the character of the work taken and the amount of time spent in the various departments.

The student must present the certificate to the Professor of Mechanical Engineering who has general supervision over all shop work.

A complete forge shop forms part of the equipment, so that efficient instruction can be given in machine shop practice, and in blacksmithing. The forge shop is located in the basement of the workshop building, and is equipped

with the latest type of down draft forges, and electric drive for the blower and exhauster.

In connection with the work in blacksmithing a short course is now given in cutting and welding by the Oxy-Acetylene process. Five welding tables and one cutting bench have been installed and completely equipped with the most modern torches and other apparatus supplied by the Dominion Oxygen Company. Instruction is also given in electric welding.

Students in all courses will be given a course of practical work in workshops of the School as per schedule of courses.

Work Shop—Second year, E, F, G, Sections 1-3, *Tuesday,* 1-3.30; Sections 4-6, *Tuesday,* 3.30-6; Sections 7-9, *Wednesday,* 1-3.30; Sections 10-12, *Wednesday,* 3.30-6.
Third Year, F, *Saturday,* 8-11 (a), 9-12 (b).
Fourth Year, D, *Friday,* 1-4, second term.

DRAWING

Professor—A. Jackson, B.Sc.
Lecturer—H. J. Styles, B.Sc. (on active service).*
Instructors—H. I. Marshall, B.Sc.; D. Jack, M.Sc.; W. E. Gorham.
Demonstrators—A. R. Asquith, B.Sc.; D. M. MacKeracher.

All drawings are to be drawn in the drafting room assigned. Drawings made by the students are considered the property of the department.

DRAWING I.

For all first year students.

Each student at the opening of the term must provide himself with a set of drawing instruments of approved standard.

The class standing will be determined by the term's work.

The work will consist of freehand lettering and sketching, geometrical drawings, auxiliary views, sections, screw threads, dimensioning, working drawings, assembly drawings, tracing, checking and blue printing.

Text-books—Svensen, *Drafting for Engineers;* Svensen, Schumann and Street, *Drafting Problem Layouts.*

Sections 1-4, *Tuesday,* 9-12; *Sections* 5-8, *Wednesday,* 9-12.

DRAWING II.

For students in Courses A, B, C, D, and M, second year.

The work will include structural and machine drawing, assembly drawings, detail drawings from free-hand sketches of details of machines, developed surfaces and intersections, tracing, checking and blue-printing.

The class standing is determined by the term's work.

Text-books—Svensen, *Drafting for Engineers;* Svensen, Schumann and Street, *Drafting Problem Layouts.*

Reference Book—*A. I. S. C. Steel Construction.*

Wednesday, 1-4.

* Lieutenant-Colonel, Royal Canadian Ordnance Corps Overseas.

DRAWING III.

For students in Courses E, F, and G, second year.

A more extended course than as outlined in Drawing II.

The class standing is determined by the term's work.

Text-books—Svensen, *Drafting for Engineers;* Svensen, Schumann and Street, *Drafting Problem Layouts.*

Reference Book—*A. I. S. C. Steel Construction.*

Monday, 3-5, first term; *Thursday,* 9-12.

PROJECTION

For first year students in all courses.

A course in the principles of Orthographic, Axonometric and Isometric Projection, and the projections of a solid revolved about different axes.

Also a short course in Descriptive Geometry preparatory to that subject in the second year dealing with problems involving true length of line and size of a plane, true slope of line and plane and projection of lines and planes on auxiliary planes.

Text-books—Svensen, *Drafting for Engineers;* Warner, *Applied Descriptive Geometry.*

Sections 1-2, *Thursday,* 9-12; *Sections* 3-4, *Friday,* 1-4; *Sections* 5-6, *Thursday,* 1-4; *Sections* 7-8, *Friday,* 8-11.

DESCRIPTIVE GEOMETRY

Required of all second year students.

This class continues the work in Descriptive Geometry which was taken in the class in Projection and includes solution of problems dealing with perpendiculars to lines and planes, intersections of planes, common perpendiculars to two lines, dihedral angles, angle between line and a plane, tangent planes, revolution of lines and planes, perspective drawing, locus of a line, and mining and guide pulley problems.

Text-book—Warner, *Applied Descriptive Geometry.*

A, B, C, D, M, *Thursday,* 1-3; E, F, G, Sections 7-12, *Monday,* 1-3; Sections 1-6, *Friday,* 1-3.

PHYSICAL EDUCATION

Medical Officer: Dr. J. T. Tweddell.

Physical Director: John F. Edwards, B.A. (on leave of absence).*

Physical Instructor: R. Seright, B.Sc.

Each first year student is given a careful examination by the Medical Officer at the beginning of his college course, the appointments being made on the day of registration. Corrective and remedial work is then given in the gymnasium when it is needed by the students.

With the exception of those excused by the Medical Officer because of ill-health, all first year students are required to take two hours of gymnasium work per week during the whole of the school year. The timetable for such classes is posted in the gymnasium very soon after registration and these classes may be taken voluntarily by any registered sophomore, junior, or senior in good standing. The work varies throughout the year and as much time as possible is spent outdoors in the early Fall and Spring. This consists of touch football, track and field, and softball, while every student is given a swimming test and the non-swimmers are automatically placed in an instruction group.

Indoor work follows with cooler weather and consists of swimming, Danish calisthenics, marching, setting up exercises, and apparatus work on the parallel bars, the horse, the mats, and the horizontal bar. The winter term brings basketball, indoor softball, group games, and indoor track and field. Each student is encouraged to learn something about all of these activities and a wide variance of exercise is achieved.

Equivalent credit is given for attendance at regular organized swimming and life-saving classes, C.O.T.C. training, and for playing on university teams in track, football, basketball, hockey, water polo, gymnastics, tennis, and boxing and wrestling. Such credit TERMINATES WITH THE REGULAR SCHEDULED PROGRAMME OF ACTIVITIES OF EACH RESPECTIVE CLUB, when students will rejoin the weekly gymnasium classes or engage in any other of the sports listed above.

All first-year students, regardless of any equivalent credit they expect, should report at the opening classes in Physical Training.

* Sub-Lieutenant, Royal Canadian Naval Volunteer Reserve.

FELLOWSHIPS AWARDED IN THE FACULTY OF APPLIED SCIENCE 1942

The Inco Scholarship—D. B. Hyland, Windsor, Ontario.

Postgraduate Scholarship in Chemical Engineering—G. A. Clark, Eden Manitoba.

Milton Hersey Fellowship—W. W. Maynard, Orillia, Ontario.

DEGREES AWARDED IN THE FACULTY OF APPLIED SCIENCE 1942

Master of Science

Name	Address
Brown, I. C., B.Sc.	Ottawa, Ontario
Griffiths, F. H., B.Sc.	Sarnia, Ontario
†Martison, N. W., B.Sc.	Arntfield, Quebec
Quinn, H. A., B.Sc.	King Kirkland, Ontario
Smeltzer, H. V., B.Sc.	Picton, Ontario

Bachelor of Science (Honours)

Acres, H. D.	Britannia Bay, Ontario
Béland, R.	Cabano, Quebec
Clark, G. A.	Eden, Manitoba
Duncan, D.	Sudbury, Ontario
Eckman, L. P.	Winnipeg, Manitoba
Elder, L. C.	Hensall, Ontario
Fraser, D. A.	Gatchell, Ontario
Hyland, D. B.	Windsor, Ontario
Meanwell, H. B.	Windsor, Ontario
Parker, E. W. E.	Ottawa, Ontario
Pasquet, P. A.	Kingston. Ontario
Smith, W. J.	Dutton, Ontario
Timm, H. A.	Westmeath, Ontario
Watson, G. R.	Oba, Ontario

Bachelor of Science (Pass)

Name	Address
Anderson, A. H.	Ottawa, Ontario
Armstrong, H. E.	Rodney, Ontario
Armstrong, J. A.	Dauphin, Manitoba
Bartlett, R. L.	Ottawa, Ontario
Bayly, J. G.	Ottawa, Ontario
Beswick, P. J.	Port Colborne, Ontario
Boucher, H. P.	Sudbury, Ontario
Brooks, J. A.	Sarnia, Ontario
†Brooks, M. L. G.	Sudbury, Ontario
Brown, G. C.	Ridgeville, Ontario
Bunston, R. F. E.	Thorold, Ontario
Campbell, D. W.	Barrie, Ontario
Campbell, G. I.	Colborne, Ontario
Carmichael, D. A.	Fort William, Ontario
†Casselman, G. A.	Berwick, Ontario
Chilman, W. R.	Hamilton, Ontario
Christie, D. J.	Calgary, Alberta
Coburn, W. R.	Brandon, Manitoba
Cockburn, K. O.	Crysler, Ontario
Coleman, R. L.	Copper Cliff, Ontario
Coté, A. P.	Cooksville, Ontario
†Craig, B. C.	Arnprior, Ontario
Crawley, T. B.	Dryden, Ontario
Daly, J. A.	London, Ontario
Diebel, J. K.	Copper Cliff, Ontario
Douglas, R. J. W.	Hawkesbury, Ontario
Dunn, R. C.	London, Ontario
Feick, J. R.	Kitchener, Ontario
Foster, D. A.	Iroquois, Ontario
Fry, C. K.	St. Thomas, Ontario
Gage, J. O.	Ancaster, Ontario
†Gilbert, L. J.	Schumacher, Ontario
Graham, A. C.	Trail, British Columbia
Graham, E. S.	Kingston, Ontario
Grandfield, N. A.	Hamilton, Ontario
Grant, G. O.	Ottawa, Ontario
Grisdale, W. L.	Kirkland Lake, Ontario

Name	Address
Haacke, E. M.	Deloro, Ontario
Hamilton, J. C.	Westport, Ontario
Hammond, H. R.	Ottawa, Ontario
Hanna, W. E.	Penetanguishene, Ontario
Hill, D. H.	Kingston, Ontario
Hood, J. R.	Galt, Ontario
Hueston, O. T.	Brockville, Ontario
Humbert, C. C.	Chandler, Quebec
Hutchison, A. M.	Windsor, Ontario
Jordan, A. T.	Yorkton, Saskatchewan
Kozlowski, H. J.	Ottawa, Ontario
Liddle, A. J. H.	Belleville, Ontario
Little, R. W.	Barrie, Ontario
Lyne, L. M.	Sioux Lookout, Ontario
Maynard, W. W.	Orillia, Ontario
Miron, E. J.	Sudbury, Ontario
Motherwell, R. K.	Ottawa, Ontario
Mullins, F. R.	Watertown, New York
Munger, H. H.	Hamilton, Ontario
Murdock, J. M.	Osgoode, Ontario
MacAskill, D.	Copper Cliff, Ontario
McCaffrey, G. F.	Stittsville, Ontario
McCallum, J. F.	Port Arthur, Ontario
McCaskill, K.	McDonald's Corners, Ontario
McCullough, J. G.	Toronto, Ontario
†McDonough, E. P.	Cobalt, Ontario
McIntosh, D. G.	St. George, Ontario
McKerrall, A. T.	Chatham, Ontario
McKinnon, H. C.	Orillia, Ontario
McLean, A. M.	Grimsby, Ontario
Nelligan, J. E.	Hamilton, Ontario
Newman, F. S.	Picton, Ontario
Perry, F. L.	Winnipeg, Manitoba
Ritchie, F. A.	Windsor, Ontario
Rivington, G. N. C.	Carp, Ontario
Rust, T. G.	Stratford, Ontario

Name	Address
Savory, H.	Hamilton, Ontario
Schultz, G. A.	Thessalon, Ontario
Scott, J. D.	Almonte, Ontario
Seldon, J. M.	Newmarket, Ontario
Seymour, D. L.	Ottawa, Ontario
Sherk, J. W.	Ridgeway, Ontario
Smith, A. R.	Saskatoon, Saskatchewan
Smith, D. L.	Lakefield, Ontario
†Smith, T. B.	Parry Sound, Ontario
Sorensen, E. E.	Kingston, Ontario
Spurr, J. C.	New Glasgow, Nova Scotia
Tait, R. E.	Sudbury, Ontario
Tetu, D. A.	Ottawa, Ontario
Tetu, H.	Ottawa, Ontario
Thomas, J. A., B.A.	Belleville, Ontario
Thomas, J. E. A.	Ottawa, Ontario
Thomson, D. W.	Toronto, Ontario
Thomson, K. D.	Winnipeg, Manitoba
Tinning, G. M.	Windsor, Ontario
Ward, J. L.	Toronto, Ontario
Weightman, O. E.	Glenboro, Manitoba
Wheal, J. W.	Hamilton, Ontario
Williams, A. R.	Ottawa, Ontario
Zavitz, R. C.	City View, Ontario

† Indicates graduates of October, 1942.

FIRST YEAR—ALL COURSES

	VIII.	IX.	X.	XI.	I.	II.	III.	IV.
Mon.	English I. Sects. 1-4 Phys. II. Lab. Sect. 5	Chem. I. Sects. 1-4 Phys. II. Lab. Sect. 5 Surv. I. Sects. 7-8	Math. IV. Sects. 1-4 Phys. II. Lab. Sect. 6 Surv. I. Sects. 7-8	Phys. I. Sects. 1-4 Phys. II. Lab. Sect. 6	English I. Sects. 5-8 Phys. II. Lab. Sect. 1 Surv. I. Sects. 3-4	Chem. I. Sects. 5-8 Phys. II. Lab. Sect. 1 Surv. I. Sects. 3-4	Math. III. Sects. 3-4 Math. IV. Sects. 5-8 Phys. II. Lab. Sect. 2	Phys. I. Sects. 5-8 Phys. II. Lab. Sect. 2
Tues.		Math. I. Sects. 5-8 Draw. I. Sects. 1-4	Math. II. Sects. 5-8 Draw. I. Sects. 1-4	Draw. I. Sects. 1-4	Math. I. Sects. 1-4 Chem. I. Sects. 5-8	Math. II. Sects. 1-4 Chem. I. Sects. 5-8	Chem. I. Sects. 5-8	Physical Training
Wed.	English I. Sects. 1-4	Chem. I. Sects. 1-4 Draw. I. Sects. 5-8	Math. III. Sects. 1-4 Draw. I. Sects. 5-8	Phys. II. Sects. 1-4 Draw. I. Sects. 5-8	Chem. I. Sects. 1-4 English I. Sects. 5-8	Chem. I. Sects. 1-4 Chem. I. Sects. 5-8	Chem. I. Sects. 1-4 Math. III. Sects. 5-8	Phys. II. Sects. 5-8
Thurs.	Phys. II. Lab. Sect. 3 Phys. I. Sects. 5-8	Projection Sects. 1-2 Phys. II. Lab. Sect. 3 Math. I. Sects. 5-8	Projection Sects. 1-2 Phys. II. Lab. Sect. 4 Math. II. Sects. 5-8	Projection Sects. 1-2 Phys. II. Lab. Sect. 4	Math. I. Sects 1-4 Phys. II. Lab. Sect. 7 Projection Sects. 5-6	Math. II. Sects. 1-4 Phys. II. Lab. Sect. 7 Projection Sects. 5-6	Phys. I. Sects. 1-4 Projection Sects. 5-6	Physical Training
Fri.	Projection Sects. 7-8	Chem. I. Sects. 1-4 Surv. I. Sects. 5-6 Projection Sects. 7-8	Math. IV. Sects. 1-4 Surv. I. Sects. 5-6 Projection Sects. 7-8	Phys. II. Sects. 1-4 Chem. I. Sects. 5-8	Surv. I. Sects. 1-2 Math. III. Sects. 5-8 Projection Sects. 3-4	Surv. I. Sects. 1-2 Phys. II. Sects. 5-8 Projection Sects. 3-4	Math. III. Sects. 1-2 Math. IV. Sects. 5-8 Projection Sects. 3-4	Engineering Society
Sat.		Phys. II. Lab. Sect. 8	Phys. II. Lab. Sect. 8					

SECOND YEAR

	VIII.	IX.	X.	XI.	I.	II.	III.	IV.
Mon.		Genl. I. A.B.C.D.M. Phys. III. E.F.G.	Phys. XIV. A.B.C.D.M. Genl. I. E.F.G., 1-6 Surv. II. E.F.G., 7-12	Math. V. A.B.C.D.M., E.F.G.H.	Miner. I. (a) A.B.C.D.M., 1 Phys. XIV. (a) A.B.C.D.M., 2 Descrip. Geom. E.F.G., 7-12 Phys. IV. (b) E.F.G. 1-4	Miner. I. (a) A.B.C.D.M., 1 Phys. XIV. (a) A.B.C.D.M., 2 Descrip. Geom. E.F.G., 7-12 Phys. IV. (b) E.F.G. 1-4	Phys. XIV. (a) A.B.C.D.M., 1 Miner. I. (a) A.B.C.D.M., 2 Drawing III. (a) E.F.G.	Phys. XIV. (a) A.B.C.D.M., 1 Miner. I. (a) A.B.C.D.M., 2 Drawing III. (a) E.F.G.
Tues.	Surv. II. E.F.G., 1-6 Mech. IX. E.F.G., 9-12	Geol. I. A.B.C.D.M. Surv. II. E.F.G., 1-6 Mech. IX E.F.G., 9-12	Phys. XIV. (a) A.B.C.D.M. Miner. I. A.B.C.D.M., (b) Surv. II. E.F.G., 1-6 Ast. II. E.F.G., 7-12	Qual. Anal. I. A.B.C.D.M. Surv. II. E.F.G., 1-6 Genl. I. E.F.G., 7-12	Phys. XIV. A.B.C.D.M., 1 Miner. I. (b) A.B.C.D.M., 2 Surv. II. E.F.G., 7-12 Shop Work E.F.G., Secs. 1-3 1 - 3.30	Phys. XIV. A.B.C.D.M., 1 Miner. I. (b) A.B.C.D.M., 2 Surv. II. E.F.G., 7-12 Shop Work E.F.G., Secs. 1-3 1 - 3.30	Phys. XIV. A.B.C.D.M., 2 Miner. I. (b) A.B.C.D.M., 1 Surv. II. E.F.G., 7-12 Shop Work E.F.G., Secs. 4-6 3.30 - 6	Phys. XIV. A.B.C.D.M., 2 Miner. I. (b) A.B.C.D.M., 1 Shop Work E.F.G., Secs. 4-6 3.30 - 6
Wed.	Surv. II. A.B.C.D.M. Genl. I. E.F.G., 1-6	Surv. II. A.B.C.D.M. Phys. IV. E.F.G.	Surv. II. A.B.C.D.M. Mech. IX. E.F.G.	Math. V. A.B.C.D.M. E.F.G.H.	Drawing II. A.B.C.D.M. Phys. III. E.F.G., 1-6 Shop Work E.F.G., Secs. 7-9 1 - 3.30	Drawing II. A.B.C.D.M. Phys. III. E.F.G., 1-6 Shop Work E.F.G., Secs. 7-9 1 - 3.30	Drawing II. A.B.C.D.M. Shop Work E.F.G., Secs. 10-12 3.30 - 6	Shop Work E.F.G., Secs. 10-12 3.30 - 6
Thurs.	Chem. II. E.F.G.	Geol. I. A.B.C.D.M. Drawing III. E.F.G.	Phys. XIV A.B.C.D.M. Drawing III. E.F.G.	Qual. Anal. I. A.B.C.D.M. Drawing III. E.F.G.	Descrip. Geom. A.B.C.D.M. Mech. IX. E.F.G., 1-4 Phys. IV. E.F.G., 5-8	Descrip. Geom. A.B.C.D.M. Mech. IX. E.F.G., 1-4 Phys. IV. E.F.G., 5-8	Mech. IX. E.F.G., 5-8 Phys. IV. E.F.G., 9-12	Mech. IX. E.F.G., 5-8 Phys. IV. E.F.G., 9-12
Fri.	Miner. I. A.B.C.D.M. Phys. IV. E.F.G.	Genl. I. A.B.C.D.M. Phys. III. E.F.G.	Surv. II. A.B.C.D.M. Genl. I. E.F.G., 7-12	Math. V. A.B.C.D.M., E.F.G.H.	Qual. Anal. I. A.B.C.D.M. Descrip. Geom. E.F.G., 1-6 Phys. III. E.F.G., 7-12	Qual. Anal I. A.B.C.D.M. Descrip. Geom. E.F.G., 1-6 Phys. III. E.F.G., 7-12	Qual. Anal. I. A.B.C.D.M.	Engineering Society
Sat	Phys. IV. (a) E.F.G., 1-4	Qual. Anal. I. A.B.C.D.M. Phys. IV. (a) E.F.G., 1-4	Qual. Anal. I. A.B.C.D.M., Ast. II. E.F.G., 1-6	Qual. Anal. I. A.B.C.D.M. Chem. II. E.F.G.				

(a)—First term. (b)—Second term.

THIRD YEAR A. B. C. D. M.

	VIII.	IX.	X.	XI.	I.	II.	III.	IV.
Mon.	Thermo. I. A.D.M.	Elect. I. A.D.M.E. (b) Gen. Chem. III. B. Met. III. (a) M.	Elect. I. A.D.M.E. (a) Min. III. (a) B.C. Min. II. (b) C. Ind. Chem. II. D. (b) Met. III. (b) M.	Met. II. A.B.M. Ind. Chem. II. D. (b)	Genl. III. A.E.G. Thermo. I. A.E.G. Org. Chem. I. B. Geol. X. C. Elect. I. D.M.	Genl. III. A.E.G. Thermo. I. A.E.G. Org. Chem. I. B. Geol. X. C. Elect. I. D.M.	Elect. I. A.E. Org. Chem. I. B. Geol. X. C. Genl. III. D.M.F. Thermo. I. D.M.F.	Elect. I. A.E. German I. B.H. Geol. X. C. Genl. III. D.M.F. Thermo. I. D.M.F.
Tues.	Min. IV. (a) A.C. Quant. Chem. II. B. Min. VII. M (a)	Mining I. A. Phys. Chem. I. B.C.D.M.	Mining I. A. (a) Geol. III. (b) A.C. Ind. Chem. II. B.D.	Geol. IV. (a) A. Met. II. (b) A.B.M. Mech. XII. (a) D.M.	Quant. Chem. I. A., Sect. 1 Fire Assay M., Sect. 1 (a) Sect. 2 (b) A. (a) Ind. Chem. II. B. Min. III. (a) C. Phys. Chem. I. C.D.	Quant. Chem. I. A., Sect. 1 Fire Assay M., Sect. 1 (a) Sect. 2 (b) A. (a) Ind. Chem. II. B. Min. III. (a) C. Phys. Chem. I. C.D.	Quant. Chem. I. A., Sect. 1 Fire Assay M., Sect. 1 (a) Sect. 2 (b) A. (a) Ind. Chem. II. B. Geol. II. C. Phys. Chem. I. C.D.	Fire Assay M., Sect. 1 (a) Sect. 2 (b) A. (a) Geol. II. C.
Wed.	Met. II. (a) A.B.M.	Mining I. A. Gen. Chem. III. B. Geol. II. C. Genl. V. D.F. Met. III. M.	Mining I. A (a) Min. IV (b) A.C. Quant. Chem. I. D.M.	Genl. V. A.M. Org. Chem. I. B.D.	Min. IV A., Sect. 1 A., Sect. 2(a) C. Geol. III. (b) A., Sect. 2 Quant. Chem. II B. Org. Chem. I. D. (a) Phys. Chem. I. M. (a) Mech. XII. D. (b), M. (b)	Min. IV A., Sect. 1 A., Sect. 2(a) C. Geol. III. (b) A., Sect. 2 Quant. Chem. II. B. Org. Chem. I. D. (a) Phys. Chem. I. M. (a) Mech. XII. D. (b), M. (b)	Min. IV. A., Sect. 2(b) Geol. III. (b) A., Sect. 1 C. Quant. Chem. II B. Org. Chem. I. D. (a) Phys. Chem. I. M. (a) Mech. XII. D. (b), M. (b)	Min. IV. A., Sect. 2(b) Geol. III. (b) A., Sect. 1 C. German I. B.H.

(a)—First term. (b)—Second term.

THIRD YEAR A. B. C. D. M.

	VIII.	IX.	X.	XI.	I.	II.	III.	IV.
Thurs.	Min. IV. (a) A.C. Quant. Chem. II. B. Mech. XII. (b) D.M. Min. VII. M. (a)	Mining I. (b) A. Phys. Chem. I. B.C.D.M.	Geol. III. (b) A.C. Ind. Chem. II. B.D.	Ore Dressing A.C.M. Chem. Eng. I. D (b)	Quant. Chem. I. A.C. Quant. Chem. II. B. Quant. Chem. I. D.	Genl. V. A.M. Quant. Chem. II. B. Quant. Chem. I. D. Geol. VII. (b) C.	Genl. V. A.M. Quant. Chem. II. B. Quant. Chem. I. D. Geol. VII. (b) C.	Genl. V. A.M.
Fri.	Ore Dressing A.C.M. (a)	Elect. I. A.D.M.E. Geol. II. C.	Min. IV. (b) A.C. Min. III. (a) B.C. Chem. Eng. I. D (b)	Geol. IV. (a) A. Org. Chem. I. B.D. Min. II. (b) C. Org. Chem. V. M.	Genl. V. D.F. Phys. Chem. I. B. Quant. Chem. I. C.M.	Genl. V. D.F. Phys. Chem. I. B. Quant. Chem. I. C.M.	Genl. V. D.F. Phys. Chem. I. B. Quant. Chem. I. C.M.	German I. B.H. Engineering Society
Sat.	Quant. Chem. I. A., Sect. 2 Quant. Chem. II. B. (b)	Quant. Chem. I. A., Sect. 2 Quant. Chem. II. B. (b) Org. Chem. I. D. (b) Ind. Chem. II. D. (a) Phys. Chem. I. M. (b)	Quant. Chem. I. A., Sect. 2 Min. III. (a) B. Quant. Chem. II. B. (b) Min. II. (b) C. Org. Chem. I. D. (b) Ind. Chem. II. D (a) Phys. Chem. I. M. (b)	Min. III. (a) B. Quant. Chem. II. B. (b) Min. II. (b) C. Org. Chem. I. D. (b) Ind. Chem. II. D. (a) Phys. Chem. I. M. (b)				

(a)—First term. (b)—Second term.

THIRD YEAR E. F. G. H.

	VIII.	IX.	X.	XI.	I.	II.	III.	IV.
Mon.	Thermo. I. E.F.G.	Elect. I. A.D.M.E. (b) Elect. IV. (a) F. Thermo. V. (b) F. Elect. III. (a) G. Elect. II. (b) G.H.	Elect. I. A.D.M.E. (a) Mun. and San. I. (b) E. Mech. I. F.G.	Rwy. & Highway E. Mech. II. (b) F.G. Thermo. V. (a) F. Phys. VII. H.	Thermo. I. A.E.G. Genl. III. A.E.G. Phys. VI. (b) H.	Thermo. I. A.E.G. Genl. III. A.E.G. Phys. VI. (b) H.	Elect. I. A.E. Genl. III. D.M.F. Thermo. I. D.M.F.	Elect. I. A.E. Genl. III. D.M.F. Thermo. I. D.M.F. German I. B.H.
Tues.	Met. I. (b) E.F.G. Math. XI. H. (b)	Hydraulics I. (a) E.F.G. Genl. II. E. (b) Mech. II. (b) F.G.	Met. I. (a) E.F.G. Mun. and San. I. (b) E. Elect. IV. (b) F. Elect. III. (b) G. Phys. VI. (b) H.	Genl. II. E. (a) Foundations E. (b) Mech. I. F.G.	Mun. and San. I. (b) E. Surv. III. (a) E. Thermo. V. F. Elect. II. G.H.	Mun. and San. I. (b) E. Surv. III. (a) E. Thermo. V. F. Elect. II. G.H.	Mun. and San. I. (b) E. Surv. III. (a) E. Elect. IV. F. Elect. II. G.H.	Elect. IV. F.
Wed.	Hydraulics I. E.F.G.	Genl. V. D.F. Elect. VI. (b) G.H. Elect. II. (a) G.H.	Surv. III. (a) E. Math. VI. (a) F.H. Math. VII. G.	Geol. IX. E. Thermo. V. F. Elect. III. G. Phys. VII. H.	Genl. VI. E. (a) Foundations E. (b) Mech. III. F.	Genl. VI. E. (a) Foundations E. (b) Mech. III. F. Phys. V. G.H.	Genl. VI. E. (a) Foundations E. (b) Mech. III. F. Phys. V. G.H.	German I. B.H.

(a)—First term. (b)—Second term.

THIRD YEAR E. F. G. H.

	VIII.	IX.	X.	XI	I	II.	III.	IV.
Thurs.	Math. XI. H. (b)	Struct. I. E. Phys. V. (a) G.H. Elect. VI. (b) G.H.	Rwy. & Highway E. Elect. III. G. Phys. VI. (b) H.	Geol. IX. E. Elect. IV. F.(a) Elect. II. G.H.	Struct. I. E. Mech. III. F. Mech. VII. G. Phys. VII. H.	Struct. I. E. Mech. III. F. Mech. VII. G. Phys. VII. H.	Struct. I. E. Mech. III. F. Mech. VII. G.	Phys. V. (b) G.H.
Fri.	Genl. VI. E. (a)	Elect. I. A.D.M.E. Mech. II. (b) F.G.	Struct. I. E. Elect. IV. F. (b) Math. VI. (a) F.H. Math. VII. G.	Hyd. I. (b) E.F.G. Phys. VII. H. (a)	Rwy. & Highway E. Genl. V. D.F.	Rwy. & Highway E. Genl. V. D.F.	Rwy. & Highway E. Genl. V. D.F.	German I. B.H. Engineering Society
Sat.	Shop Work F. (a) Math. XI. H. (b)	Shop Work F. Elect. III. G.	Shop Work F. Elect. III. G. Phys. VI. (b) H.	Shop Work F. (b) Elect. III. G.				

(a)—First term. (b)—Second term.

FOURTH YEAR

	VIII.	IX.	X.	XI	I.	II.	III.	IV
Mon.	Mining II. A. Metallography I. (a) M. Metallography II. (b) M.	Econ. I. A.B.C.D.M. E.F.G.H.	Mining II. A. Min. II. (b) A. (Geol. opt.) Min. III. (a) A. (Geol. opt.) Phys. Chem. II. B.D.M. Struct. IV. (a) E. Hydraulics II. F. Elect. VIII. G.H.	Geol. VIII. A.C. Chem. Eng. III. D. Mun. & San. II. E. Elect. VII. F. Elect. V. G. Phys. IX. H.	Ind. Chem. III. B. (a) Chem. Opt. B. (b) Mining IV. C.M. Chem. Eng. III. D. Struct. II. E. Mech. V. F. Elect. X. G. Elect. XI. G.H.	Ind. Chem. III. B. (a) Chem. Opt. B. (b) Geol. VI. C. Chem. Eng. III. D. Met. VII. M. Struct. II. E. Mech. V. F. Elect. X. G. Elect. XI. G.H.	Ind. Chem. III. B. (a) Chem. Opt. B. (b) Geol. VI. C. Chem. Eng. III. D. Met. VII. M. Struct. II. E. Mech. V. F. Elect. X. G. Elect. XI. G.H.	German I. C. Chem. Eng. III. D. (b) Mech. V. F.
Tues.	Mining II. A. Phys. Chem. II. B.D.M.	Met. IV. A.M. German II. B.H. Geol. VI. C. Thermo. II. D. Thermo. III. F. Eng. Rel. E. Elect. V. G.	Mech. IV. (a) A.E.G. Hydr. IV. (b) A.D.M. Phys. Chem. III. B. Min. V. (a) C. Chem. Eng. V. (a) D. Struct. II. (b) E. Mech. V. F. Elect. XI. (b) G.H. Phys. X. H. (a)	Geol. VIII A.C. Org. Chem. II. B. Chem. Eng. IV. (b) D. Met. V. (a) M. Mun. and San. III. E. Elect. X. G. Elect. XI. (a) G.H. Phys. X. H. (b)	Min. III. (a) A. (Geol. opt.) Mining II. (a) A. Mech. IV. (b) A.E.G. Coll. Chem. II. B. (a) Chem. Opt. B. (b) Fire Assay (a) C. Coll. Chem. I. (a) D. Metallography I. M. (a) Metallography II. M. (b) Genl. IV. (a) E. Mech. V. (a) F. Hydr. III. (b) F. Elect. VIII. G.H. (a) Phys. X. H. (b)	Min. III. (a) A. (Geol. opt.) Mining II. (b) A. Coll. Chem. II. B. (a) Chem. Opt. B. (b) Fire Assay (a) C. Coll. Chem. I. (a) D. Metallography I (a) M. Metallography II. (b) M. Genl. IV. (a) E. Mech. V. (a) F. Hydr. III. (b) F. Elect. VIII. G.H. (a) Phys. X. H. (b)	Geol. II. A. (Geol. opt.) Chem. Opt. B. (b) Fire Assay (a) C. Chem. Eng. III. D. (a) Metallography I (a) M. Metallography II. (b) M. Genl. IV. (a) E. Mech. V. (a) F. Hydr. III. (b) F. Elect. VIII. G.H. (a) Phys. X. H. (b)	Geol. II. A. (Geol. opt.) Fire Assay (a) C.

(a)—First term. (b)—Second term.

FOURTH YEAR

	VIII	IX	X.	XI.	I	II	III	IV
Wed.	Met. VI. (b) M.G. Mech. V. F.	Geol. V. A.C. Thermo. II. D. Thermo. III. F. Hydraulics II. E.G. Math. X. H.	Mining II. A. Coll. Chem. II. B. (a) Coll. Chem. I. (a) D. Ind. Chem. I. E. Mech. XI F. Elect. IX G. Elect. XII. G.H.	Met. IV. A.M. Ind. Chem. III. B. (a) Coll. Chem. II. B. (b) Geol. XII. (a) C. Min. V. C. (b) Chem. Eng. II. D. (a) Chem. Eng. IV. D. (b) Highway E. Mech. XI. F. (a) Phys. IX. H.	Mining III. A. Phys. Chem. II. B.M. Thesis C. Thermo. II. (a) D. Chem. Eng. II. D. (b) Struct. IV. E. Elect. VII. F. Hydr. III. (a) G. Elect. VIII. G.H. (b)	Mining III. A. Phys. Chem. II. B.M. Thesis C. Geol. XII (a) C. Thermo. II. (a) D. Chem. Eng. II. D. (b) Struct. IV. E. Elect. VII. F. Hydr. III. (a) G. Elect. VIII. G.H. (b)	Mining III. A. Phys. Chem. II. B.M. Thesis C. Geol. XII. (a) C. Thermo. II. (a) D. Chem. Eng. II. D. (b) Struct. IV. E. Elect. VII. F. Hydr. III. (a) G. Elect. VIII. G.H. (b)	German I. C.
Thurs.		Mech. IV. A.E.G. Geol. VI. C. Chem. Eng. V. D. Met. V. (b) M. German II. B.H. Hydr. II. F.	Hydr. IV. A.D.M. Min. V. C. Chem. Eng. IV. D. (b) Phys. Chem. III. B. Struct. II. E. Mech. VI. F. Elect. IX. G. (b) Elect. XII. G.H.	Met. IV. A.M. Org. Chem. II. B. Chem. Eng. IV. D. (a) Struct. IV. E. Mech. VI. F. (a) Mech. XI. F. (b) Elect. V. G. Phys. X. H.	Min. VI. (a) A. (Geol. opt.) C.M. Org. Chem. II. B. Met. Lab. M. (a) Highway E.(a) Mun. and San. II. E.(b) Mun. and San. III. E.(b) Thermo. III. (a) F. Elect. V. G. Phys. XIII. H.	Geol. VII. (b) A. (Geol. opt.) Org. Chem. II. B. Min. VI. (a) A. (Geol. Opt.) C.M. Phys. Chem. II. D. Met. Lab. M. Highway E.(a) Mun. and San. II. E.(b) Mun. and San. III. E.(b) Thermo. III. (a) F. Elect. V. G. Phys. XIII. H.	Geol. VII. (b) A. (Geol. opt.) Org. Chem. II. B. Min. VI. (a) A. (Geol. Opt.) C.M. Phys. Chem. II. D. Met. Lab. M. Highway E.(a) Mun. and San. II. E.(b) Mun. and San. III. E.(b) Thermo. III. (a) F. Elect. V. G. Phys. XIII. H.	Phys. Chem. II. D. Met. Lab. M. (b)

(a)—First term. (b)—Second term.

FOURTH YEAR

	VIII	IX	X	XI	I	II	III	IV
Fri.	Hydr. IV. (a) A.D.M. Chem. Opt. B. (b) Met. VIII. (a) F.	**Milling** **A.M.** Chem. Opt. B. (b) Chem. Eng. III. D. Hydr. II. E.G. Met. VIII. (a) F. Mech. X. F. (b) Math. X. H.	Min. III. (a) A. (Geol. opt.) Milling A.M. Coll. Chem. II. B. (a) Chem. Opt. B (b) Chem. Eng. III. D. Struct. IV. E. Mech. X. F. Elect. V. G. (b) Elect. IX. G. (a) Phys. X. H. (a)	Min. II. (b) A. (Geol. opt.) Milling A.M. Ind. Chem. III. B. (a) Coll. Chem. II. B. (b) Geol. XII. (a) C. Chem. Eng. II. D. Struct. IV. E. Mech. X. F. (a) Thermo. IV. F. (b) Elect. V. G. (a) Phys. IX. H.	Milling A.M. Phys. Chem. III. B. Thesis C. Min. V. C. Shop Work (b) D. Struct. II. E. Thermo. IV. F. Elect. V. G. Phys. XIII. H.	Milling A.M. Phys. Chem. III. B. Thesis C. Min. V. C. Shop Work (b) D. Struct. II. E. Thermo. IV. F. Elect. V. G. Phys. XIII. H.	Milling A.M. Phys. Chem. III. B. Thesis C. Shop Work (b) D. Struct. II. E. Thermo. IV. F. Elect. V. G. Phys. XIII. H.	German I. C. **Engineering** **Society**
Sat.		Milling A.M. Org. Chem. II. B. Chem. Eng. II. D. (a) Hydr. III. E. (b) Mech. Eng. VIII F. Elect. IX. G. Elect. XII. G.H.	Min. II. (b) A. (Geol. opt.) Milling A.M. Org. Chem. II. B. Chem. Eng. II. D. (a) Hydr. III. E. (b) Mech. Eng. VIII. F. Elect. IX. G. Elect. XII. G.H.	Min. II. (b) A. (Geol. opt.) Milling A.M. Org. Chem. II. B. Chem. Eng. II. D. Hydr. III. E. (b) Mech. Eng. VIII F. Elect. IX. G. Elect. XII. G.H.				

(a)—First term. (b)—Second term.

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